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Foreword

TAKE 2018 follows with success the two previous editions. We gather 60 papers, presented by scholars from 15 countries which address the complex relation between theory and applications in the realm of the knowledge economy. We address specific aspects of knowledge management, human resource development and management, intellectual capital and many other scientific areas relevant for the economy of today. We hope these proceedings will summarize and illustrate well what happened in the conference and look forward for next years' edition.

Thank you very much for your participation as local organizer, keynote speaker, stream leader, reviewer, author, helper or just participant.

Eduardo Tomé, Conference Chair

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Accounting Systems and Auditing

Ivana Mamić Sacer and Beata Zyznarska-Dworczak

As an important part of information system, accounting is an inevitable source of information for business decision making. The importance of accounting system is recognized by different users. It is the most regulated information system within the entity. It offers wide variety of information; planned and realised, detail and summarized, etc. On the other hand, internal controls and different types of auditing increase confidence in accounting information. Internal control systems express managements' effort in the improvement of business operation. Since International financial reporting standards are principle oriented standards, gathering knowledge about different techniques and methods that arise from their application can be an interesting field of research. Papers of this stream remark that internal controls, the application of accounting standards, and different types of auditing can influence financial information disclosed in principle financial statements. Since the accounting standards have been a subject to change, it is important to investigate their impact on information. Furthermore, research results on auditing methodology, standards, reports, etc. and can enhance knowledge in the profession that is of great priority to the users of accounting information.

Management Accounting Innovations and the Impact of Organizational Culture, Power, and the Role of Actors: A Case Study Enlighthened by Institutional Logics Perspective

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Abstract: The scope of this paper is the organizational context of a Portuguese government agency, where a profound process of institutional change occurred between 2004 and 2013. Consequently, innovative management accounting and management control frameworks and practices (basically a quality programme and a balanced scorecard, duly integrated into a strategic plan) were implemented. Institutional theory and particularly the institutional logics perspective (Friedland and Alford, 1991; Lounsbury, 2007; Thornton and Ocasio, 2008) were used to inform the investigation. The empirical study showed evidence of a strong interaction between the macro (societal) level, the meso (organizational/institutional field) level and the micro (organizational) level. Therefore, main insights came from the 'Integrative model of the microfoundations of institutional logics' (Thornton et al., 2012). This model combines the interinstitutional system and the cross-level effects, identifying the mechanisms or elements that can influence change processes resulting in social practices and structures, and emphasizing the action of actors.

To support the investigation, a longitudinal, retrospective and in-depth longitudinal case study was conducted at the field site, where two research questions were posed: i) how did the organization embark on an organizational change process, and which were the main elements and mechanisms found in the process?; ii) can the 'Integrative model of the microfoundations of institutional logics' (Thornton et al., 2012 – Thornton et al.'s model) explain the process of institutional/organizational change and the implementation of innovative management accounting frameworks and practices in the government agency? Thus, interviews were conducted inside and outside the field site, and specific data and written material were collected, so that findings and evidence could imply the full answer to those research questions. The case study is mainly explanatory as existing theory is used to understand and explain the specific (Ryan et al., 2002).

Sets of multiple logics were found in the field site. Concretely, public administration mode logics, compliance logics and management logics emerged as a response on the organizational (micro) level to pressures and trends from the upper field levels – societal (macro) and organization field (meso) levels.

Findings indicate that the main elements or mechanisms, which supported the change process and the implementation of innovative management accounting frameworks, were culture, communication/negotiation, mobilization, power, and the role of actors, directed to decision making. One of these elements is identified in the Thornton et al.'s model at the societal and the organization field levels - culture. Power is linked to negotiation/communication and mobilization, and is seen in the model as a link between the micro and macro levels. However, in the field site, all these elements were found at the micro (organizational) level. Other elements were found in the organization (micro) level, particularly the role of actors which is not seen in the Thornton et al.'s model. This is a contribution of the study. Moreover, the combination and linkage of the several elements of the Thornton et al.'s model were mostly identified in the empirical study. Thus, the Thornton et al.'s model explains basically the events that occurred in the field site where the research was conducted as well as the reasons why the change process took place. This is another contribution of the paper.

1 Introduction

The performance and efficiency of organizations and the improvement of management systems have been crucial concerns challenging academics and practitioners for many years (Fitzgerald, 2007). Accordingly, particularly in the last 25 years, financial performance measures did not capture all demands of the changing environment (e.g. customers' satisfaction, quality, or innovative managerial systems). These new demands required that organizations must adapt to the new business environment, where technological and organizational changes occur frequently (Johnson and Kaplan, 1991). In the management accounting domain, new management systems and frameworks have been developed since then, such as management control, management by objectives (MBO), activity-based costing, total quality management (TQM), balanced scorecard (BSC) or organizational change management (Hopper et al., 2007). These innovative management frameworks have been adopted particularly in the private sector, but also in the public sector (Hood, 1995).

Institutional theory is one of the social theories used by researchers within the interpretive perspective¹. Following a pragmatic-interpretative view of management accounting, the main concern is with management accounting practice, including the organizational consequences of its applications. The gap between theory and practice (Scapens, 1990, 1994, 2006; see also Bourdieu, 1977, 1990, who mentions that an adequate theory of practice must include a theory of scientific practice) implies that management accounting must be seen, above all, as "social and institutional practice rather than the direct application of textbook techniques" (Wickramasinghe and Alawattage, 2007: 8). Moreover, institutional embedded praxis also deserves great empirical attention by researchers, being an essential driving force of institutional change (Seo and Creed, 2002).

Institutional theory has become very popular in organizational analysis. Several branches of institutional theory have been characterized by researchers in the last decades. Oppositely to new institutional economics (NIE), an extension of neoclassical economics and focusing on

¹ The term 'perspective' is adopted herein in the way Wickramasinghe and Alawattage (2007) used in their book "Management Accounting Change: Approaches and Perspectives". Accordingly, perspectives are "alternative theories which are capable of explaining the practices of management accounting" (2007: 15).

rationality, old institutional economics (OIE) – at the micro level –, and new institutional sociology (NIS) – at the macro level –, consider the active roles of institutions to help in understanding accounting practices (Wickramasinghe and Alawattage, 2007). In line with recent research that highlights the combination of the impact of institutional pressures (macro level) in organizations, with internal dynamics of change in organizations (micro level) (Dillard et al., 2004; Cruz et al., 2009; Hopper and Major, 2007), the institutional logics perspective has been recently regarded by researchers as a powerful theoretical lens to explain institutional change (Thornton et al., 2012).

The scope of this paper regards institutional change. In particular, a deep process of change, translated into the implementation of innovative management accounting and control frameworks in an organization (a government agency entitled Instituto de Gestão Financeira da Segurança Social² - IGFSS), is analysed and discussed. Institutional theory is the theoretical 'umbrella' that supported the investigation conducted. Particularly the institutional logics perspective (a branch of institutional theory – Thornton et al., 2012) was adopted as the theoretical framework used to analyze management accounting change in IGFSS, by identifying political and cultural reasons (DiMaggio and Powell, 1983; Martin and Frost, 1996; Scott, 2013; Drori, 2008, for world culture), resources dependency (Greenwood et al., 2008; Oliver, 1991; Pfeffer and Salancyk, 1978), power (Clegg, 1989, 2009; Clegg et al., 2006; Hardy and Clegg, 1996; Haugaard and Clegg, 2009; Lawrence, 2008), or the role of actors (Battilana et al., 2009; DiMaggio, 1988; Fligstein, 1997, 2001; Lawrence and Philips, 2004) as elements or factors that explain the occurrence of change and evolution in organizations (Thornton et al., 2012).

The purpose of the research is to understand how the organization responded to the pressures and trends that came from the societal field and the organizational field levels, and how it has dealt with management change between 2004 and 2013, following an institutional logics perspective. Moreover, the investigation intends also to find how the case study and the respective change process are informed by the 'Integrative model of the microfoundations of institutional logics' (Thornton et al., 2012), taking into consideration that this model and the several elements/factors integrating the model will possibly explain the micro dynamics of accounting change in the organization, and the observed practices.

As previously mentioned, a change process was analyzed in IGFSS, a field site where innovative management accounting frameworks were implemented and bundled during the period under analysis. Among those frameworks, BSC, MBO, and a quality management program (similar to TQM) were implemented and integrated in a strategic plan. Consequently, a qualitative research design was followed and particularly a longitudinal case study was carried out in the organization (2010-2013). Interviews to managers and analysis of written documentation were the most important sources of data. The case study is categorized as explanatory (Ryan et al., 2002; Scapens, 1990), because existing theory is used to understand and explain the specific (Ryan et al., 2002).

Some contributions have been highlighted by this study. Sets of multiple logics were found in the study. Some identified logics are not seen in existing literature. Second, the main elements that supported the change process and the implementation of innovative management accounting practices were culture, communication/negotiation, mobilization, power, and the

² Social Security Financial Management Institute

role of actors, directed to decision making. Oppositely to the institutional logics perspective global view, some of these elements were found at the micro (organizational) level. Third, the combination and linkage of the several elements of the 'Integrative model of the microfoundations of institutional logics' (Thornton et al., 2012) were mostly identified in the field site where the research was conducted. Thus, this model is an adequate model to explain the reasons why the change process took place. Moreover, as very few practical situations regarding change management have been developed and studied in the public sector, the study also helps to close this gap.

This study is structured as follows. In section two, literature review is presented, focusing mainly on institutional theory and particularly on the institutional logics perspective as the main theoretical framework which supports the investigation. The 'Integrative model of the microfoundations of institutional logics' (Thornton et al., 2012) is presented and analyzed. In section three, a description of the field site where the research was conducted is presented. An overview of the innovative frameworks which were implemented in the scope of the change process is also provided. Section four discusses the research methods, sources of evidence and methodology used in the investigation. Research questions are also listed. The empirical study is developed in section five. The study ends with discussion and conclusions in section six.

2 Theoretical framework

The institutional logics perspective and the 'Integrative model of the microfoundations of institutional logics' are the theoretical basis supporting this study. The origin of this theoretical domain is NIS (Thornton et al., 2012).

NIS highlights political and cultural reasons (rather than technical ones) for the existence of certain social and organizational practices, which may come along through institutional pressures. These practices encompass change processes, being the role of change, ambiguity and constraint, and the implications of these organizational characteristics for the social structure as a whole, very important factors to analyze in the neoinstitutionalism domain (DiMaggio and Powell, 1983).

Beyond technical knowledge, organizations reflect also the cultural rules and social beliefs in their environments. Institutional theorists have been documenting “the influence of social and symbolic forces on organizational structure and behavior...and examined how institutional systems shape organizations, variably, as a function of their location in the environment, their size and visibility, and their nearness to the public sphere, structural position, and relational contacts” (Scott, 2013: 217). Meyer and Rowan (1977) present a radical position by mentioning that many organizations reflect the myths of their institutional environments instead of the demands of their work activities and that “independent of their productive efficiency, organizations which exist in highly elaborated institutional environments and succeed in becoming isomorphic with these environments gain the legitimacy and resources needed to survive” (Meyer and Rowan, 1977: 352). Furthermore, these researchers state that organizations, when adapting to institutional environments, can play active roles in shaping those contexts. If stability exists in organizations, adaptation to environmental changes and reforms always occur in organizations (Meyer and Rowan, 1977).

Adaptation to environment in a government agency implies the introduction of the public administration and management (PAM) modes. Diffusion of innovative management accounting frameworks and practices in the public sector imply the association with public administration reforms. These reforms followed during the last decades the evolution of PAM, visualized in three different modes: i) Traditional public administration (PA); ii) New public management (NPM); and recently, iii) New public governance (NPG) (Osborne, 2006).

NPM is “a general theory or doctrine that the public service can be improved by the importation of business concepts, techniques and values” (Pollitt, 2009: 201) emphasizing performance assessment through setting of goals and the measurement of outputs (Hood, 1995). NPM is still present in many countries, but in other countries NPM evolved in the last 20 years to NPG or new public service (NPS) (Denhardt and Denhardt, 2000). This mode (NPG/NPS) is characterized by orientation to public service, attending to citizens’ interests, and desire to contribute to society (Denhardt and Denhardt, 2000; Osborne, 2006; see also Wiesel and Modell, 2014, who repudiate a radical transition from NPM to NPG/NPS).

2.1 Recent directions in institutional theory

In spite of being considered by researchers a powerful theoretical framework to explain change, and how macro structures and culture shape organizations (Thornton et al., 2012), NIS framework presents also limitations, such as the static character and the way it deals with intra-organizational issues. NIS has focused primarily on convergent change involving outcomes or the diffusion of new practices. Particularly, NIS explains the “adaptation of management accounting techniques and the existence of subsequent management accounting practices” (Wickramasinghe and Alawattage, 2007: 433), Yet, it neglects “how new practices emerge and treats organizations as unitary, passive entities or black-boxes that only gain legitimacy by conforming to environmental demands” (Hopper and Major, 2007: 64). Moreover, NIS has been criticized for neglecting internal organizational dynamics and factors (power, conflict or change processes). Finally, economic pressures and symbols are identified as self-evident (what is not true – they are socially constructed) (Hopper and Major, 2007; see also Battilana et al., 2009; Dacin et al., 2002; Lounsbury and Crumley, 2007).

In a micro-level approach, the degree of institutionalization also affects major aspects of cultural persistence and is influenced, beyond the organizational context, by personal influence and by ‘office’ (in logistic terms). This means that macro and micro-level are strongly linked (Zucker, 1977). Moreover, “neoinstitutionalists ordinarily operate at the macro-level, focusing on the role of an institutionalized environment in legitimizing organizations and their structures ... focusing on the content, rather than the process, of institutionalization ... this implies that institutional theory is always in danger of forgetting that labeling as process or structure does not explain it” (Zucker, 1991: 104-105). Thus, the process by which this occurs remains a ‘black box’.

Contributing to close this gap on this branch of institutional theory, some researchers have been building frameworks based on NIS but incorporating characteristics of OIE, namely the intra-organizational and procedural kind of analysis. In turn, OIE can be extended by considering the impact of institutional pressures and the processes through which such pressures can trigger changes (Ribeiro and Scapens, 2006). Combining both frameworks, Dillard et al. (2004) developed a model (institutional relational dynamics model) that considers macro-level and micro-level analysis, highlighting, beyond the dynamics of embedding and change at the organizational level, the socio-economic and political context,

and also the organizational field level (Dillard et al., 2004). Other researchers have deepened the internal dynamics of the organizations, in particular dynamics of change. These internal dynamics of change arise frequently from voluntarism of actors and may imply the implementation of more effective outcomes, exploring the role of actors in shaping and influencing change (Cruz et al., 2009; Hopper and Major, 2007; see also Scott, 2013). In organizations, actors influence the institutionalization process, at the micro-level, but mainly as a reaction to pressures and trends from the organizational context and the environment, which may be classified as convergent change (Scott, 2013). Indeed, “without a solid cognitive, micro-level foundation, we risk treating institutionalization as a black box at the organizational level, focusing on content at the exclusion of developing systematic explanatory theory of process, conflating institutionalization with resource dependency, and neglecting institutional variation...that can engender differentiation rather than isomorphism” (Zucker, 1991: 105).

Another framework exploring the internal dynamics of organizations was proposed by Hopper and Major (2007). These researchers proposed an extended model of the Dillard et al. (2004) model, translating operating and legitimate practices (in the original model) into a working practice enacted at intra-organizational level (versus the original organizational level). In line with this view, the practice variation approach is a framework that connects institutional change to variation within the scope of organizational practices (Lounsbury, 2001; Cruz et al., 2009; Cruz et al., 2011, who observe that when management control systems are localized and enacted, practice variation can occur; see also Ezzamel et al., 2012). The concepts of logics and multiple logics (Lounsbury, 2007, 2008) also help to analyze and interpret practice variation.

The ability and role of actors in the creation, diffusion, change or stabilization of organizational practices is crucial to the understanding of new institutional analysis of organizations. Hence, the role of actors and action in the process of institutionalization began to be analyzed and investigated (Christensen et al., 1997). Consequently, the importance of institutional change processes and the interaction between actors’ actions and the institutions/organizations where they are embedded, have been highlighted nowadays by institutional theory (Leca and Naccache, 2006). This perspective is closely linked to the concept of institutional entrepreneurship, which is defined as the “activities of actors who have an interest in particular institutional arrangements and who leverage resources to create new institutions or to transform existing ones” (DiMaggio, 1988; Maguire et al., 2004: 657; see also Garud et al., 2002; Greenwood and Suddaby, 2006; Hardy and Maguire, 2008). Consequently, institutional entrepreneurship is fully associated with change and today institutional theory addresses institutional change (Scott, 2013). Another framework which intends to explain the occurrence of change exploring the internal dynamics of organizations, particularly the role of actors was proposed by Battilana et al. (2009) - the model of the process of institutional entrepreneurship. This model identifies three different stages of the process of institutional entrepreneurship. First, enabling conditions for institutional entrepreneurship may imply the emergence of institutional entrepreneurship. Second, in order to implement divergent change, actors must be engaged in some key activities. Finally, if divergent change takes place, it can be diffused and, consequently, institutional change occurs.

Institutional theories can be very helpful to understand the diversity in management accounting practices. In 1970, academics felt satisfied by communicating to practitioners the relevant theory and models previously developed, expecting practitioners to apply them in practice and learn how to apply them (Scapens, 2006). “The problem was that they never

really did” (Scapens, 2006: 3; see also Bourdieu, 1977, 1990; and Scapens, 1994, who discusses a gap between practice and theoretical material, and encourages researchers to look in-depth at management accounting practices, and not to dismiss practices which do not conform to mainstream).

Today, researchers “have a much better understanding of the complexity of processes which shape management accounting practices; the research has followed practice – with researchers seeking to understand and theorize what practitioners do and how practices evolve. The challenge for the future is to use this theoretical informed understanding to provide insights which are relevant and useful for practitioners; for management accounting research to have more of an impact on practice” (Scapens, 2006: 28).

The study of these internal dynamics and practices and the inherent role of actors in organizations have shown, however, that more studies of institutional change and action in intra-organizational levels are needed (Leca et al., 2008). In line with these concerns, and complementing in a concise way the ‘body’ of the recent trends in institutional theory, the institutional logics perspective represents an analytical framework for institutional analysis. The framework also addresses significant contributions to the study of how institutions both enable and constrain action (Thornton et al., 2012).

2.2 The institutional logics perspective and the 'Integrative model of the microfoundations of institutional logics' (Thornton et al., 2012)

Today, the institutional logics perspective is considered by researchers as a metatheory, signaling research on institutional logics as a core concept characterized by a distinctive perspective that is building upon, yet departing from, the foundations of neoinstitutional theory, solving critical problems for institutional analysis more broadly (Thornton et al., 2012; see also Thornton and Ocasio, 2008). Moreover, the institutional logics perspective is seen as a core perspective in organizational analysis and in sociology (Greenwood et al., 2008).

Thornton et al. (2012) discuss that “the concept of institutional logics is intuitively attractive, but arguably difficult to define and even harder to apply in an analytical useful manner” (2012: 1; see also Thornton and Ocasio, 2008). The ‘birth’ of the concept of institutional logics is usually attributed to Friedland and Alford (1991). “Institutions are supraorganizational patterns of human activity by which individuals and organizations produce and reproduce their material subsistence and organize time and space (1991: 243). These researchers state that the understanding of individual or organizational behavior must imply the integration into a societal context, being “society composed by multiple institutional logics which are available to individuals and organizations as bases for action” (1991: 253). Institutional logics are present in institutional orders of Western societies, being symbolic grounded, and organizationally structured. “Put succinctly, institutional logic is the way a particular social world works” (Jackall, 1988: 112). To achieve and explain institutional change, the mobilization of different institutional logics (which are embodied in practices), implies action of individuals on (seeking) status of culture, power, control of resources, and political struggles (Friedland and Alford, 1991; Jackall, 1988; Thornton and Ocasio, 2008).

The concept and application of the concept of institutional logics have been widely used since then. For example, Thornton and Ocasio (1999) conducted a study where they identified how the dominant institutional logic in an industry changed “from the logics of profession to the

logic of markets” influencing “the social organization of attention, decision making, and the use of alternatives sources of power in organizations” (1999: 802, 803).

The most commonly used definition of institutional logics is presented by Thornton and Ocasio (1999), who borrowed from the developments of Jackall (1988) and Friedland and Alford (1991). These authors define institutional logics “as the socially constructed, historical pattern of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality” (Thornton and Ocasio, 1999: 804), reproducing also their lives and experiences (Thornton et al., 2012). The institutional logics perspective is seen as a theoretical model defining in each institutional order the principles, practices, and symbols that influence individual and organizational behavior, conditioning actors’ choices for sense making, their sense of self and identity, and shaping how reasoning takes place and how rationality is perceived and experienced. Behavior is a very important part of the concept, because it can be powerful and strategic (Thornton et al., 2012; see also Ocasio, 1997, and Thornton and Ocasio, 1999, who highlight the impact of rules, interaction, and interpretation in structuring cognition and in decision-making). A simple concept was recently presented by Ocasio et al., 2015 – “institutional logics are cultural structures that bring order to domains of practice” (2015: 28). Considering the difficulty to define and apply in practice the concept (Thornton et al., 2012), and taking advantage of the previous contributions, institutional logics can be defined, synthetically, as the broad scope of cultural factors and material practices in organizations, where institutional actors are embedded, that influence and underpin their behavior and decision-making.

Figure 1 presents the “Integrative Model of the Microfoundations of Institutional Logics” (Thornton et al., 2012) (henceforth Thornton et al.’s model). The model is the outcome of an inter-connection between two models: i) the interinstitutional system, and ii) the cross-level effects. Consequently, the theory underlying the institutional logics perspective “assumes that institutions operate at multiple levels of analysis with potential for cross-level interaction effects” (2012: 14; see also Thornton and Ocasio, 2008). This is a new view of institutional logics, as a branch of institutional theory, which still needs to be tested by empirical research (Thornton et al., 2012; see also Thornton and Ocasio, 2008, who mention that more work on the microfoundations of institutional logics is needed, at various levels of analysis; and Lounsbury and Boxenbaum, 2013, who mention that research on institutional logics is, today, an excellent opportunity for academic development, pointing to many fruitful avenues for fruitful research). However, extending the concerns of Thornton and Ocasio (2008) and Thornton et al. (2012) regarding the difficulties associated with the concept of institutional logics, the model is not an easy model to apply in practice.

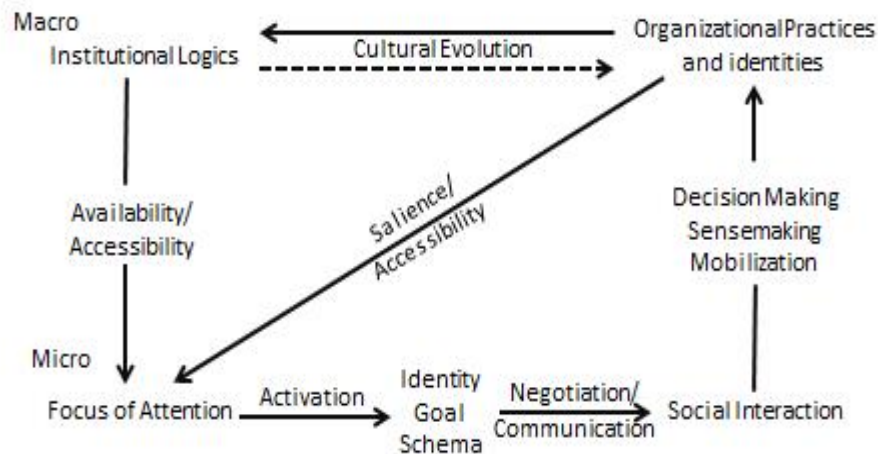


Figure 1: An Integrative Model of the Microfoundations of Institutional Logics (Thornton et al., 2012: 85)

These multiple levels of analysis comprise a set of mechanisms by which institutional logics shape power in organizations (Thornton and Ocasio, 1999). Three nested levels constitute the dominant theoretical perspective in political sociology – individuals, organizations and society (Alford and Friedland, 1985). Seminal papers on institutional theory clearly identify these three levels: i) societal level, associated with environmental Western culture (Meyer and Rowan, 1977), developing the community logic (Thornton, 2004); ii) organizational field level (DiMaggio and Powell, 1983; Tolbert and Zucker, 1983); and iii) organizational (micro) level (DiMaggio, 1988; Oliver, 1991; Tolbert and Zucker, 1983; Zucker, 1977, 1991) (see also Scott, 1995, 2013, who identifies a top level – societal institutions, an intermediate level – fields and organizations, and a bottom level – actors; and Thornton and Ocasio, 1999, who mention macro level, industry/organizational level, and organizational actions and decisions level). The role of culture in interpretation and engagement in practices is strongly emphasized by individuals and organizations (Thornton et al., 2012). The institutional logics perspective, as a social theory, must work at these “three levels of analysis - individuals competing and negotiating, organizations in conflict and coordination, and institutions in contradiction and independence” (Friedland and Alford, 1991: 240-241).

The institutional logics approach as a metatheory implies the need to develop research at a variety of different levels of analysis. The focus is “on the effects of differentiated institutional logics on individuals and organizations in a larger variety of contexts” (Thornton and Ocasio, 2008: 100). Theoretical and empirical research has been developed at these multiple levels of analysis. Thus, literature shows studies on societal level logics and the respective impact on individuals and organizations (Friedland and Alford, 1991; Haveman and Rao, 1997); on societal level logics and the impact on organizational field (Scott et al., 2000); on the organizational field level and the impact on organizations (Greenwood and Suddaby, 2006; Jackall, 1988; Lounsbury, 2007); on organizational field level (Thornton and Ocasio, 1999); and on organizational field level and the impact on the interinstitutional system (Thornton, 2004).

The basis of the Thornton et al.’s model is the assumption that institutions include actors (organizations or individuals) who act basically under the influence of a societal context (or macro level), of culture, of power, and of resources, rejecting the rational-choice theory (Friedland and Alford, 1991). Indeed, society (comprising different institutional orders) and

social relations consider material elements - structures and practices (DiMaggio and Powell, 1983), symbolic elements - ideation and meanings - and culture (Meyer and Rowan, 1977) as key elements to bring the influences of society back into institutional analysis (Thornton et al., 2012; see also Friedland and Alford, 1991). "By integrating the symbolic with the material, the institutional logics perspective integrates research on culture and cognition to provide an orienting strategy for a theory on how culture shapes action" (Thornton et al., 2012: 11; see also DiMaggio, 1997). Consequently, individuals and organizations act and make decisions based on the differences in cultural norms, symbols, and practices, and the Thornton et al.'s model provides elements in the interinstitutional system that can explain the origins of innovative ideas and institutional change (Thornton et al., 2012).

The recursive characteristic of actors' actions is also present in the institutional logics perspective. Indeed, beyond the reproduction of behaviors consistent with existing institutional logics, actors also have the capacity to innovate and transform institutional logics, which implies that societal (macro) institutional logics can be manipulated, combined, translated or adapted to meso or micro processes of change, taking advantage of opportunities for change (Thornton et al., 2012; see also Friedland and Alford, 1991, for the societal/macro level). The recombination of institutional logics by individuals/actors through switching referent categories from different institutional orders is a key characteristic of the Thornton et al.'s model. These institutional logics are presented in literature as multiple and/or competing logics.

The institutional logics concept has also been presented in literature, together with more proactive definitions of multiple and competing/conflicting logics. Multiple logics can create diversity in practice by enabling variety in cognitive orientation and emphasize organizational and intra-organizational research on practice. At the organizational level multiple logics can focus the attention of key decision-makers (Lounsbury, 2008). Indeed, Lounsbury (2001, 2007, 2008) highlights the dialogue with practice theorists, the need to account for actors and practice diversity/variation, and the study of practice that attends to both institutional and micro-processual dynamics. In practice, "different interactions and organizational practices within organizations and fields may be guided by different logics" (Thornton et al., 2012: 99). The concept of competing logics has been recently used in research on institutional change as a way to focus on competition between alternative logics, being competing logics an antecedent or consequence for change (Thornton and Ocasio, 2008; see also Pache and Santos, 2013a, 2013b). Associated with this concept, conflicting logics and prevailing/dominant logics have been also mentioned in literature (Besharov and Smith, 2014; Purdy and Gray, 2009; Thornton and Ocasio, 2008; Thornton et al., 2012).

Moreover, recent theoretical developments identify four different types of logic multiplicity in organizations. Depending on the degree of centrality (high or low) and on the degree of compatibility (low or high) different types of logics are identified. Strongly based on competing and/or conflicting logics, a framework discussed by Besharov and Smith (2014) identifies: i) contested logics (high centrality and low compatibility, where an extensive conflict is visualized); ii) estranged logics (low centrality and low compatibility, where the conflict is moderate); iii) aligned logics (high centrality and high compatibility, where there is minimal conflict); and iv) dominant logics (low centrality and high compatibility, existing no conflict). The response of individuals, within organizations, to competing institutional logics was categorized in five types of responses, reflecting a richer repertoire of behaviors based on the

complexity of the relationship between individuals and their institutional environment: i) ignore; ii) comply; iii) defy; iv) compartmentalize; and v) combine (Pache and Santos, 2013a).

Consequently, the institutional logics perspective is a metatheoretical analytical framework which analyzes the interrelations among institutions, individuals and organizations in social systems, clarifying how individual and organizational actors are influenced by their situation in multiple social locations, and create and modify elements of institutional logics (Thornton et al., 2012; see also Child, 1972, who focuses on how organizational decision-makers make strategic choices as a response to contextual pressures, maintaining or transforming institutions).

The Thornton et al.'s model (cf. Figure 1) presents very important elements and processes/perspectives between the several levels of institutions which influence actions and decisions of organizations and individuals (the macro and the micro levels are clearly visualized, but the meso level is also present). The key elements visualized in the model which are crucial to influence institutional change are: i) culture; ii) focus of attention; and iii) social identities, goals, and schemas.

Culture is seen in the model as a global/world 'umbrella' presenting characteristics of Western culture (Drori, 2008). The role of culture and cognition have permanently highlighted in institutional analysis (DiMaggio, 1997; Meyer and Rowan, 1997; Swidler, 1986; Zucker, 1977). Culture influences actors' choices and patterns of behavior through values that direct actors to some ends rather than others, using culture as a 'toolkit' (Swidler, 1986). Moreover, cultural symbols and practices can be manipulated by actors in organizations, using storytelling (Battilana et al. 2009; Zilber, 2007), rhetorical strategies (Greenwood and Suddaby, 2006; Hardy and Maguire, 2008; Suddaby and Greenwood, 2005), or discourse and language (Hinings et al., 2004; Lawrence and Philips, 2004; Maguire and Hardy, 2006; Ocasio et al., 2015; Philips and Hardy, 2002; Philips et al., 2004). Considering the possibility for individuals and organizations to fit practical needs in specific local settings, the interinstitutional system included in Thornton et al.'s model provides a nearly decomposable model of culture (Thornton, 2004). Within the scope of institutional analysis, culture is viewed as an embedded element which can influence power and competition in a significant way (DiMaggio, 1991; Stinchcombe, 2002). Within the scope of the institutional logics approach, cultural dimensions of institutions both enable and constraint social action, shaping action and strategic decisions (Thornton and Ocasio, 2008).

The focus of attention (or attentional perspective – Ocasio, 2011) is a key element in the model. As shown in Figure 2, it is an intermediate factor that connects the encompassing institutional (and multiple) logics and cultural embeddedness to organizational decision making. Thornton and Ocasio (1999) reinforce this view by focusing on social organization of attention and decision making at the organizational level (comprising actions and decisions). Consequently, attention of decision makers affects the ability of social actors in organizations to respond to upper field levels factors, trends and pressures, helping to explain whether and how firms adapt to changing environments (Ocasio, 1997, 2011). These institutional logics' macro-to-micro effects are boosted through individual and organizational cognition (Thornton, 2004; Thornton and Ocasio, 1999; Thornton et al., 2012).

The attention of decision-makers influences firm behavior. Indeed, "decision-makers will be selective in the issues and answers they attend to at any one time, and what decision-makers do depends on what issues and answers they focus their attention on" (Ocasio, 1997: 189-

190). Moreover, several empirical studies show that institutional logics usually focus the attention of decision-makers on actions and solutions consistent with prevailing logics (Lounsbury, 2007; Thornton and Ocasio, 1999, 2008). On the other hand, focus of attention can be driven by goals, logics of action, top management teams, experience, or prior experience (Ocasio, 2011), and is the trigger for actors role (Thornton et al., 2012). Consequently,

“institutional logics shape the accessibility, attentional focus, and activation of identities, goals, and schemas that guide cognition and social interaction; ... we highlight the role of availability, accessibility, and activation in both automatic and controlled attentional processes ... and generate top-down attentional perspectives for processing information and for focusing attention, and, oppositely, focus of attention is shaped by bottom-up environmental stimuli” (2012: 90, 91).

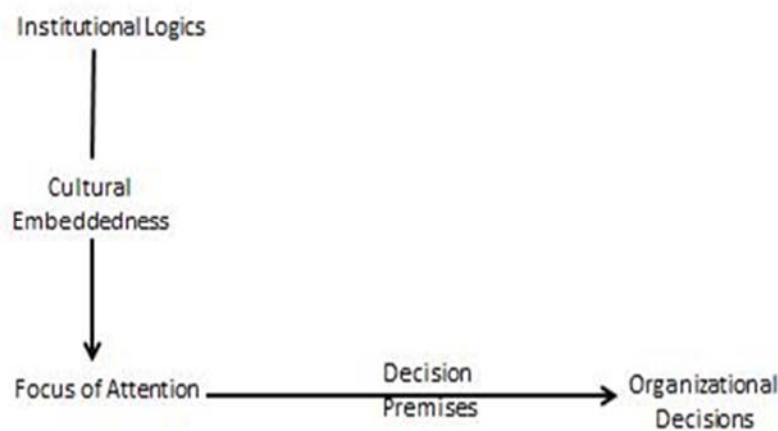


Figure 2: Institutional Logics and Attention (Thornton et al., 2012: 81)

An important set of key elements in the model is comprised by social identities, goals, and schemas. Multiple social identities characterize the role of individuals as social actors, being defined relationally in a broader scope of a social actor’s relationship with other social actors (Thornton et al., 2012). Multiple goals exist in organizations’ and individuals’ conception of management; social actors have multiple goals and their behavior is driven, at least in part, by the consequences of achieving or not achieving their respective goals (2012: 87). Identities and goals affect cognition and action in diverse situations and domains, being activated by the focus of attention (Ocasio, 1997; Thornton et al., 2012). “An institutional logics perspective posits that goals, like social identities, are culturally embedded within alternative institutional logics” (Thornton et al, 2012: 87). Institutional logics help social actors (as managers embedded in practical logics) generate top-down knowledge structures or schemas to process information and guide decision-making (Thornton, 2004). “The schema concept highlights how actors understand, remember, and act upon complex information” (Thornton et al., 2012: 88).

The processes/perspectives allow the linkage of the several elements of the model and the effectiveness of the cross-level effects that compose the Thornton et al.’s model. These main processes/perspectives are presented next: Salience is a contributor factor to strengthen the bottom-up attention, and “refers to the extent to which certain environmental features stand

out relative to others” (Thornton et al., 2012: 92). On the other hand, the focus of attention is shaped by attentional processes through the availability, accessibility, and activation of identities, goals, and schemas. Activation depends on interaction with other social actors with greater power. The focus of attention must be experienced at both the individual level and the social level (Thornton et al., 2012). The reproduction and transformation of organizational and institutional structures is done by social actors interacting with other social actors. These social interactions are crucial to the success of negotiations, exchanges, and communication, being the attention of social actors driven by conversations, language, negotiation and communication (2012).

Decision-making, sensemaking and collective mobilization are key processes/perspectives included in the Thornton et al.’s model. These elements are crucial so that actors (individual or collective) may succeed in the implementation of institutional change and/or transformation of institutions (Thornton et al., 2012; Lawrence et al., 2011). Moreover, these mechanisms are crucial to assure recursively in the model. “Organizational decision-making is an opportunity for change in existing logics underlying organizational identities and practices” (Thornton et al., 2012: 95). Decision-making is based on actions and behaviors, and has consequences on social interaction. In line with this perspective, sensemaking is a process by which social actors turn circumstances into situations, guiding action of social actors. “Sensemaking is an ongoing retrospective process that rationalizes organizational behavior” (2012: 96). The role of language, vocabularies, and rhetorical devices are emphasized in sensemaking (Suddaby and Greenwood, 2005; Thornton et al., 2012). Supporting these processes directed to the achievement of the objectives concerning the new management model and the change process, communication (basically internal, which involves all staff) and negotiation are crucial mechanisms to be used by social actors.

Finally, “mobilization is the process by which collective actors acquire symbolic and material resources and motivate people towards the accomplishment of group or collective goals” (Thornton et al., 2012: 97). Regarding collective mobilization, it is usually a consequence of appropriate collective identities among individuals of multiple social groups, and of collective involvement (Haveman and Rao, 1997; Hardy and Maguire, 2008; Hargrave and Van de Ven, 2006; Jackall, 1988; Lounsbury, 2002; Lounsbury and Crumley, 2007). Collective mobilization is a key element to link social action to decision-making and organizational practices.

With respect to the mutual influences between the several elements/factors of the model, some processes/perspectives and effects must be highlighted within the scope of institutional logics, as a way to better explain institutional change: i) The links between logics and practice (Bourdieu, 1977; see also DiMaggio, 1991, who propose at the micro level a theory of practical action). Supporting this view, Scott (2013) mentions that decisions and choices result as an admixture from rational calculations and nonrational premises; ii) The effects between logics, control and decision making (Fligstein, 1987); iii) The effects of institutional logics on organizational action through theories (and focus) of attention (Thornton, 2004; Thornton and Ocasio, 1999); iv) The direction of attention to alternative sources of power in organizations (Thornton and Ocasio, 1999).

Other elements not directly visualized in the model are seen in literature as crucial elements associated with institutional logics perspective and the ability to induce, trigger and explain institutional change. “The treatment of the concept of power (not sufficient condition to explain institutionalization or institutional change) is the most salient critique of the

institutional logics perspective” (Thornton et al., 2012: 64). However, power and status are important mechanisms explaining individual and organizational action (Thornton and Ocasio, 2008; see also Zilber, 2008, who highlights the importance of power relation dynamics). From an institutional logics perspective, power and status are associated with prevailing institutional logics, influencing action and decision-making of social actors (Jackall, 1988; Lounsbury, 2002; Ocasio, 1999; Thornton and Ocasio, 1999, 2008). Indeed, power is an overall element in institutional theory which influences significantly institutional change (Clegg, 1989, 2009; Clegg et al., 2006; Hardy and Clegg, 1996; Haugaard and Clegg, 2009; Lawrence, 2008). The theorization of power was discussed by Stinchcombe (2002). First, he mentions that “power is created in the course of action, so the power is not in general prior to the action it explains”. Second, he concludes “that the use of power is rational or strategic action”. Consequently, power and the role of actors are crucial to explain institutional change (Fligstein, 2001; Levy and Scully, 2007).

“From an institutional logics perspective, social actors are key to understanding institutional persistence and change” (Thornton et al., 2012: 76). This role of social actors in institutional analysis can be linked to the concept of institutional entrepreneurs (Battilana et al., 2009; DiMaggio, 1988; Hardy and Maguire, 2008; Maguire et al., 2004; Powell and Colyvas, 2008), but comprehends a much wider scope.

The role of social actors is crucial in shaping and being shaped by institutions and consequently in the implementation of change processes. Indeed, institutional logics provide social actors with impetus and motivation for the development of current organizational culture. Oppositely, the role of social actors influences also the reproduction and transformation of institutional logics (Thornton et al., 2012). Actions associated with change comprise mobilization of resources, mobilization of staff, use of power, communication, motivation, or social interaction, directed to decision-making (Battilana et al., 2009; Hardy and Maguire, 2008; Lounsbury, 2007; see also Cooper et al., 2008, who highlight the importance of powerful agents who ‘must’ possess power to change things).

Pache and Santos (2013a) complement the Thornton et al.’s model “by identifying the individual-level conditions under which embeddedness in competing logics may trigger reflexivity and agency on the part of organizational actors” (2013a: 6). This model presents a more comprehensive approach directed to the micro-foundations of institutional theory, discussing the roles individuals play in the institutional environment, both sustaining and triggering changes, or ranging from passive to more proactive roles (Pache and Santos, 2013a; Powell and Colyvas, 2008).

In sum, Thornton et al. (2012) mention that

“the institutional logics perspective provides an overarching meta-theory that can contribute to wider scholarly interest in practice by emphasizing the embeddedness of individuals in society and institutional fields and providing a theoretical architecture that makes contributions to knowledge more visible” (2012: 180).

3 The field site

IGFSS is a government agency that manages the social security system in Portugal. The organization develops its activity in four main departments/business units (BUs): i) financial

management (FM), aiming at optimizing the management of the financial resources on a basis of financial surplus; ii) budget and account (BA) (managing the global social security system budget - around 36,300 million euros in 2012); iii) real estate (RE), managing around 4,500 sites by the end of 2012, which come usually from pledge; iv) debt management (DM). The main activity is the management of the debts from debtors to the whole social security system. In particular, the recovering of these debts is developed under the responsibility of the DM department and is carried out by decentralized BUs, the debt management recovery local services (DMLS), located all over the country. The DM department manages globally the debt processes, including coercive collection. The board of directors (BD) manages globally the organization. Beyond the BUs, there are five supporting areas, being the most important the board support department (BS), which is responsible for supporting the global management in a management control perspective, and for strongly advising the BD with respect to strategy, the management model, the management frameworks, the policies and initiatives, and the objectives.

IGFSS develops its activity under the supervision of the Ministry of Social Security and Labor (MSSL). This implies that it is integrated into the indirect administration of the state. However, the institute has administrative and financial autonomy, and manages its own assets. IGFSS was created in 1977 within the social security system, which was still in its early stages in Portugal. In the course of time, it has become one of the strong pillars of the sustainability of the financial system. The mission of the organization is directed to rendering services to citizens with quality, assuring the clients to be satisfied, and intending to be a leading institute in the quality of public service. To achieve this purpose, the organization adopts innovative management frameworks aiming at the satisfaction of the citizens/clients' needs.

A process of institutional change occurred in IGFSS between 2004 and 2013. This institutional change process took place in an organization duly integrated into an environment where societal field (macro), and organizational field (meso) trends were identified. Facing these trends, IGFSS responded in a convergent change process that extended the compulsory or challenger demands from the environment. This response reflected the internal dynamics of the organization.

After the change process and the implementation of new and innovative management frameworks, the organization developed new policies and management practices, oriented not only to financial results and perspectives, but also to outcomes linked to quality management, such as satisfaction of customers/citizens' needs, public service mission, serving the citizens, employees satisfaction and motivation, or continuous improvement. The most important key performance indicators of IGFSS during aforementioned period were: i) 1940 thousand processes of debt collection managed (351 in 2004); ii) 583 million euros of debt collection in 2012, contrasting to 66.2 million euros in 2004; iii) 82% of clients were satisfied as an average in 2012, versus 64% in 2006; iv) 77% of staff were satisfied in 2012 (69% in 2006); and v) 379 employees worked in IGFSS by the end of 2012, versus 450 in 2004. This allows a clear visualization of the evolution in the period under analysis. The improvement in the main indicators is clear and evident, either on a financial basis, or on a non-financial basis, particularly in what relates to quality management.

4 Methodology

A qualitative research design was followed in this investigation. Concretely, a retrospective and in-depth longitudinal case study was conducted in the field site, IGFSS. The purpose of the research was to obtain a holistic and integrated understanding of management control and management accounting practices in the organization and of the change process. Moreover, the aim was to analyse how IGFSS dealt with the trends and pressures that existed at the societal and organizational field levels, how the organization responded to those trends, and how the dynamics of accounting change can be explained by institutional theory, broadly, and by the institutional logics perspective in particular. Consequently, the purpose includes theorizing from the findings that are expected to be found. Thus, the case study is basically explanatory, as existing theory is used to understand and explain the specific (Ryan et al., 2002). To this end, methodologically, the aim was to obtain findings and explanations to the research questions and to the applied conceptual model (Miles and Huberman, 1994). Case study investigation has also been recommended by management accounting practices, particularly when research is developed in complex organizational settings (Eisenhardt, 1989; Kaplan, 1986; Scapens, 1990). Thus, case and field studies are the most appropriate to explain the observed practices. Indeed, “case studies offer us the possibility of understanding the nature of management accounting in practice; both in terms of the techniques, procedures systems, etc, which are used and the way in which they are used” (Scapens, 1990: 264; see also Ryan et al., 2002).

Case studies are also appropriate for contributing to close the gap between theory and practice in the academic and scientific community, bridging theory and practice (Scapens, 1994, 2006). The investigation followed the stages/steps suggested by Scapens (1990), Ryan et al. (2002), and Yin (2014) to conduct case studies. Those stages/steps are: i) developing a research design; ii) preparing to collect data and evidence; iii) collecting evidence; iv) assessing evidence; v) identifying and explaining patterns; vi) theory development; and vii) report writing. Furthermore, the stages/steps were not followed sequentially but interactively.

The investigation was conducted between January 2010 and January 2013 and consisted of collection of data from interviews and from documentation and written material. Both types of data implied sources inside and outside the organization. Interviews were conducted inside and outside the organization. Inside IGFSS, it was possible to embrace a wide scope representing the most important departments of the organization, located in the headquarters as well as in the decentralized DMLS throughout the country. All significant BUs were covered by interviews, as well as the most important support areas. On the other hand, members of the board of directors (BD), managers and technicians were also covered by interviews.

Outside the organization, interviews encompassed previous members of the BD, the supplier of the BSC framework, members from MSSL, including the former minister when the events occurred, and members representing the societal field (macro) environment. At this level

members of the IPSG which 'produced' the common assessment framework - CAF³, a tool that influenced significantly the change process in the organization, were interviewed.

The collection of data also comprised documentation, written material, intranet material, and videos on the management model from seminars or workshops, collected inside the organization. Globally, management accounting and control frameworks, including performance measurement systems (PMS), the BSC framework, quality measurement systems and the quality manual, and the strategic plans (2010-2012 and 2013-2015) were consulted and analyzed, as well as annual financial and activity reports, and internal communication documents. Outside IGFSS, governmental legislation, CAF, and documentation from the European Union (EU), from the Organization for Economic Cooperation and Development (OECD), from the European Foundation for Quality and Management (EFQM), and from the European Institute for Public Administration (EIPA) were also analyzed.

The research comprised three phases. In all phases interviews and documentation analysis took place. The first phase of the investigation consisted of a pilot study in IGFSS from January to May 2010. 24 interviews were carried out during this period, and covered the several BUs of the organization, in headquarters as well as in decentralized DMLS. The complexity and richness of the study and the need to understand the elements and factors that supported the change process across the country implied that a large number of interviews were conducted in this phase. Consequently the output obtained surpassed the traditional pilot study.

The 24 interviews conducted in the pilot study lasted 34 hours. The average was one hour and 25 minutes per interview. Most of the interviews at this stage were conducted inside the organization. 16 interviews occurred in the headquarters and seven took place in the decentralized DMLS throughout the country, where top managers were interviewed. In the headquarters, six interviews encompassed managers of the board support department. The other ten interviews in the headquarters encompassed managers and technicians of other main departments and business units. Appendix 1 presents a table listing the 47 interviews that were globally conducted in the investigation. This list is separated into the three different phases that covered the research. Moreover, extensive documentation and written material were collected and analyzed. Within the scope of the pilot study, a preliminary research design was prepared in order to identify the scope of the investigation and the potential and opportunities to be developed. Research design is the logic that links data and conclusions of the study to the initial questions previously raised (Yin, 2014).

The second phase of the investigation began in October 2010 and lasted till April 2011. The purpose was to generate evidence that could help to answer the preliminary research questions drawn by the pilot study. 11 interviews were conducted; interviews provided insightful data on IGFSS practices and allowed for the comprehension of the influences and impact from upper institutions that embrace the organization. Concretely, those 11 interviews lasted fourteen hours and forty minutes (an average of one hour and twenty minutes), and were conducted inside (six interviews) and outside the organization (five interviews).

³ Social Security Financial Management Institute

Particularly, a Portuguese member of the IPSP and the former minister of MSSL in 2004-2005 were interviewed. Some documentation was analyzed in this phase, namely the strategic plan of IGFSS and documentation collected at the societal level.

The third and last phase of the research took place between September 2011 and January 2013, and the main objective was to find explanations and answers to the research questions (which were reassessed and re-defined at the end of the second phase). Two research questions were then posed: i) how did the organization embark on an organizational change process, and which were the main elements and mechanisms found in the process?; ii) can the 'Integrative model of the microfoundations of institutional logics' (Thornton et al., 2012) explain the process of institutional/organizational change and the implementation of innovative management accounting frameworks and practices in the government agency? In this phase, 12 interviews were conducted, eight inside the organization (three in the headquarters and five in the decentralized DMLS) and four outside. These last ones comprised the current Secretary of State (MSSL) head of office, the former minister of MSSL, his former permanent secretary and another Portuguese member of the IPSP. These 12 interviews lasted fourteen hours and forty minutes, implying an average of one hour and thirteen minutes per interview. At this stage all documentation and written material previously collected were analyzed. New documentation was also collected. All reports, plans, budgets, communication issues, and frameworks of IGFSS were extensively analyzed. When necessary, triangulation was made, including clarification of doubts with interviewees.

Broadly speaking, 47 interviews were conducted, involving twenty-six interviewees (see Appendix 1). These interviews lasted 63 hours and 20 minutes, which implies an average of one hour and 20 minutes per interview. The range was from 30 minutes to two hours. 37 interviews were conducted in IGFSS and ten outside the organization. Considering the interviews in the organization, 25 were conducted in headquarters and 12 in decentralized DMLS throughout the country. Considering the interviews outside the organization, one was conducted in Quidgest (the supplier of BSC framework), four involved the MSSL (including the former minister), three involved the European Union (EU) (the Portuguese members of the IPSP) and two involved former members of the BD.

All the interviews in decentralized DMLS comprised top managers, but in headquarters the interviews involved three members of the BD (including the President), eight top managers, one middle manager and five technicians. In some situations, more than one interview was conducted to interviewees. This was the case when time was not sufficient to conclude the interview in a profitable way or when it was necessary to specify and clarify important questions.

Following Yin (2014) recommendations, some principles were followed in the investigation, in order to assure validity and reliability. First, when necessary, multiple sources of evidence and triangulation (data, events, and methods) were used. Second, case study databases were created and storyboards were made to support the analysis of each interview. These databases and storyboards proved to be very efficient in the management of data, in organizing the answers in themes, and in the identification of patterns, due to the large amount of data collected. Finally, a chain of evidence was maintained (Miles and Huberman,

1994). Whenever necessary, feedback meetings occurred with interviewees, which helped to validate the evidence collected, the findings, and to confirm the explanations previously given. Beyond data, triangulation was also used on informants' discourses. In fact, the large number of interviewees and the diversity of themes and areas of research of the case study implied sometimes the need to verify and confirm the statements of interviewees. Consequently, the explanations previously advanced could be confirmed. Some tactics were implemented to test, confirm and generate meanings, assuring the quality of the conclusions. As soon as the sequence of important events was identified, a critical incident chart and time line was produced. In particular, the tactics developed to generate meanings in the case study are "noting patterns and themes, seeing plausibility, and clustering⁴, which help the analyst see 'what goes with what'" (Miles and Huberman, 1994: 245).

The interviews were the main source of evidence. Broadly, the interviews were semi-structured. To achieve efficiency in the conduction of interviews, a guide and some initial structured questions were designed and supported the development of the interviews. However, some interviews were unstructured, mainly when the story of the change process was evidenced (e.g., the interviews involving the 'producers' of information – BS top and middle managers). Most of the interviews were tape-recorded and transcribed. Only when there were no logistic conditions or when authorization was not granted, tape-recording was not performed. 80% of the interviews were tape-recorded and transcribed. During the conduction of the interviews, notes and observations were produced when the relevance of some situations (facial expressions and gestures of the interviewees, or emphasis on response) needed to be highlighted. At the end of each interview, the quality of tape-recording was confirmed, as well as the validity of the notes taken. When necessary, additional notes were taken.

The purpose and methods of the investigation were also presented at the beginning of each interview, as well as the reference to confidentiality of the information provided by the interviewee. Thus, an easy and free communication pervaded, in general, the interviews. Sometimes, the interviewees asked not to tape-record specific considerations and statements. When these situations occurred, notes were accurately taken.

Considering the questions, direct and non-direct ones were posed, depending on the purpose of the researcher. Direct questions were used to obtain quick and assertive answers, and non-direct questions were used to provoke a developed reasoning. An open-ended discussion was usually carried out at the end of the interviews, so that interviewees could express their own experience and perspective. Sometimes, interviewees were encouraged to speak freely about what they thought about the new management control systems, how these systems were implemented, and were affecting them in their daily activities. Furthermore, beyond the 'feedback meetings' previously mentioned, some informal telephone and follow-up mail contacts were made in order to specify short questions and to clear up some doubts.

⁴ "Clustering is a general name given to the process of inductively forming categories, and the iterative sorting of things – events, actors, processes, settings, sites – into those categories" (Miles and Huberman, 1994: 249).

5 The empirical study

Since the early 2000s, a deep organizational change has occurred in IGFSS. This institutional and organizational change process was translated, as an output, into the implementation of a new management model and of new and innovative management accounting and control frameworks and practices. According to the management model the performance measurement systems were duly aligned with quality management systems, allowing the organization to successfully respond to regulatory demands.

Like most public institutes, in the 1980s and 1990s in Portugal, IGFSS used as a support management mode the traditional public administration (PA) one. This mode was orientated to the compliance of legislation, administration of set rules and guidelines, a commitment to budget, and a bureaucracy policy (Osborne, 2006). Efficiency, outcomes or concept of 'clients/citizens' were not considered at all. Sometimes information was missing and, when existing, it was available too late for decision-making. Later, after the consolidation of the change process, PA evolved, first to new public management (NPM) and next to new public service (NPS), reflecting the influence of multiple logics (Lounsbury, 2007).

In the 1990s, a global public administration reform (PAR) was launched by the Portuguese government. There was an atmosphere favourable to the introduction of reforms in Portuguese public services in the 2000s, as a consequence of the increase of harsh criticism addressed to the mismanagement of public resources. Such reforms were a challenge to government agencies and consequently some ministries launched a quality management program, based on CAF and TQM.

In order to support the management philosophy, the organization improved significantly the practical use of management frameworks and the strategic alignment through the new management model. Such a model was deeply influenced by external pressures from the environment (societal level). PAR was a fashion public philosophy in the 1990s, in Portugal. This explains the ministries' and government agencies' willingness to changes in management. In 1993, some guidelines and principles from the Al Gore report ("Government that works better and costs less") and also from the book "Reinventing Government", by David Osborne and Ted Gaebler, were quickly disseminated at global level, and Portugal followed the trend. These guidelines embraced NPM ideas. Moreover, the Organization for Economic Co-operation and Development (OECD) approved, in 1986, a report called "Administration as a service, the public as client", with the aim of improving the relations between the public and the administration. Concretely, the report mentions explicitly:

"The broad, institutional arrangements of the public service, at all levels, must be considered as the essential context for improving administration responsiveness. Public servants should be motivated, through incentive systems, to be responsive to clients. Communication with clients, and administrative procedures must be designed better to satisfy the needs and capacities, rather than the needs of hierarchy, control and internal communication" (pp. 64, 94).

Finally, important trends and guidance came from the Lisbon Strategy (2000). The intention was to deal with low productivity and stagnation of economic growth in the EU comparing with the United States (US).

Besides, CAF was launched in Portugal as a challenge to government agencies. CAF was inspired by EFQM BEM, and was created by the innovative public services group (IPSG) in Europe, in 2000. Six European countries were involved, including Portugal. To give technical support, the European

Commission, EIPA, EFQM and the Speyer Academy (Germany) were also represented in IPSG (EIPA, 2013).

At the organizational field level, the MSSL launched a quality program directed to government agencies under its supervision, following CAF guidelines. CAF was one of the triggers that IGFSS (through the BS department manager, with full sponsorship of the BD) found in order to implement a deep organizational change since 2004. CAF was launched as a challenge (not compulsory) and, in the 2000s, it began to be implemented in public organizations across Europe. CAF is a quality management framework, based on TQM and inspired by well-known total quality models, in particular the 'excellence model' of the EFQM. CAF has three main purposes: i) to allow public managers to improve their skills and apply quality management and the principles of TQM to public organizations, using and understanding self-assessment; ii) to act as a bridge between the several models and methodologies used by public managers in quality management (for example, the EFQM 'excellence model'; and iii) to promote benchmarking between public-sector organizations (Ministry of Social Security and Labor, 2004).

CAF was built on NPM, directed to quality and performance management. A pilot version was presented in May 2000 and revised versions were launched in 2002, 2006 and 2013, as a result of the feedback obtained from the organizations that implemented successfully the framework (EIPA, 2013). External feedback and control of CAF are regularly developed by EIPA (EIPA, 2013). In September 2010, 2 066 organizations in 39 countries (31 European) used CAF. In Europe, Portugal was the fifth in the list of organizations that have implemented CAF. On that date, Portuguese 112 public organizations had implemented the framework (EIPA, 2013; Staes and Thijs, 2010).

The MSSL adopted CAF in a very enthusiastic way and a specific committee was created, the quality program group, in order to create a quality program with the purpose of: i) reduction of costs of non-quality; ii) optimization of resources; iii) rationalization of processes; iv) improvement of service to clients; v) motivation of employees; vi) sponsorship of top management; and vii) satisfaction of citizens' needs in general (Ministry of Social Security and Labor, 2004). This quality program was based on CAF and was launched in 2004, initially as a challenge to 17 agencies of the ministry. The quality program was not compulsory, but recommended. However, it was a 'strong' recommendation, sponsored by the Minister. The first stage of the program went well and 70% of the agencies actively participated in activities. However, in 2005 the Minister who actively sponsored the project left (due to a new government) and the program slowed down. Thus, only six agencies tried to implement CAF. Some succeeded, others did not. However, IGFSS was the government agency that went further, and implemented, not only CAF, but also a quality manual based on the certification with ISO 9001. Indeed, IGFSS faced this program as a challenge and an opportunity of innovation, development, effectiveness, and optimization of resources.

Consequently, at the beginning of 2005, a quality committee was created in the organization aiming at the global objective to improve the quality of public services. This committee was composed of five members. The future head of the BS department who, up to then, was working in the internal audit department, integrated this group. The other members were representatives from the information systems department, from the financial BU, from the human resources department and from the communication department.

Guided by of the Portuguese Ministry of Government Administration (acting as a pivotal organization, at the organization field level), CAF was disclosed through all the ministries in Portugal. Consequently, other ministries also tried to implement a similar quality program and a quality manual, following and trying to replicate the successful model launched in IGFSS. The authors of the quality program in MSSL

presented the program in workshops that were held in other ministries, in 2005. The Ministry of Education, the Ministry of Finance, the Ministry of Home Affairs, some municipalities, and the autonomous regions of Azores and Madeira were receptive to implement the framework but did not go ahead with a formal development. Only the Ministry of Science created a specific committee and launched a similar framework in 2007/2008, but the success was limited.

Another trigger for the change process was the MBO system, which was launched in 2003/2004, presenting mainly financial indicators, but also some non-financial. MBO was the first approach for a change process in IGFSS, having a significant impact on the emergence of a new culture in the organization, leaving behind the full absence of accurate and on-time data. Based on MBO, some global objectives were defined and some monitoring reports (not regular) were produced:

'Before 2004 there was no concern about strategy; only a set of objectives were defined, mainly linked to great projects. A limited number of indicators were presented and it was difficult to measure them in a specific time-period. The measure was also not accurate and there were no scorecards. Data were not available online and it took a week to produce a performance monitoring report. Moreover, only some staff usually acceded to results and performance' (BS department head, April 2012).

At the same time (2004), SIADAP – Sistema integrado de avaliação do desempenho da administração Pública (Performance appraisal system for public administration) was implemented. SIADAP was compulsory by law (meaning compliance with regulatory powers), assessing government agencies, managers and staff. Following these actions, a very important trigger action occurred in the organizational structure. The BS department was created still in 2005, comprehending not only the responsibility for the management control model (including BSC and the strategic plan), but also the responsibility for the quality management program, based on TQM and an internal communication plan. The BS department head mentions:

'The new BD asked me to assume those objectives and create a new department (the current BS) whose functions were characterized by planning, management control and communication. The integration of communication into this department proved to be a determinant factor for the successful implementation of the new practices. In the beginning I was alone, preparing all data for management control, including the variance analysis. Later I was authorized to recruit some staff. The basis for recruitment was the quality committee' (January 2010).

Supporting the main structure of the model, a quality management program, very much based on TQM, was implemented, as well as a performance management program based on BSC. In 2006, the BSC framework software was acquired and the BSC methodology was gradually implemented in IGFSS. The BS department was decisive for the conception of a new and very well-conceived strategy, translated into the implementation of the change process and the innovative management frameworks.

In 2005, a new BD was appointed. A compulsory compromise to the ministry (expressed initially by a management contract called 'mission charter' and 2008 onwards by another management contract) implied the development, at all organization levels, of a culture directed to results, considered as the basis of the management system the BD intended to launch. This management contract was also a way to integrate and facilitate the performance assessment through SIADAP. The objectives/indicators (lead and lag) that were defined can be divided into five groups: i) quantitative financial indicators; ii) quantitative operational indicators at the level of debt collection and real estate management; iii) implementation of an intra-communication plan and management control frameworks; iv) diffusion of

satisfaction questionnaires; v) quality awards. Sequentially, the BSC was implemented, firstly as a supporting tool of the activities plan in 2006, and, in 2007, as a framework for strategic management (strategy maps were produced). The staff felt motivated and actively participated in the process:

'All of us actively participated in the process of strategy definition and of setting the objectives. We used to analyze and discuss the objectives for the next time-period under analysis, as well as analyze the results and outcomes achieved. When the results are great in our service, the staff sees the impact of their work and decisions online. (DMLS manager, February 2010).

The BS department was crucial for the definition of the strategy, taking advantage of the opportunity which arose from the government compulsory demands (SIADAP and the management contract) and from the challenge sponsored by the ministry (CAF/quality program). The management model is directed to organizational change and is based on the production of data that allow the performance measurement of the organization, including response to regulatory demands (SIADAP and the management contract) through the compulsory frameworks, the three year strategic plan (2010-2012), encompassing the management contract adopted for the new tenure (2009-2012), and the control and decision-making process.

The head of BS department conducted the process with full support of the BD:

'I was very curious about innovation in management models and I had already heard something about the BSC. Thus, I attended a seminar by David Norton in 2005 where I realized that a BSC could be the answer for a management model to support our change process. The BD fully supported the idea and sponsored the project. (January 2010).

The head of BS department acted as an institutional entrepreneur. Furthermore, she has a very strong power of inducement.

'The head of BS department is an innate leader. She has a very strong inducement power. She 'sold' very well the new management model and the BSC and the need of a cultural change to the other managers of the organization' (BS middle manager, November 2012).

'I tried to 'sell' the idea that this was a very important framework to managers. Thus, I succeeded in involving the managers, in particular the DMLS managers. I also always felt the sponsorship of the BD, who was usually present in the first workshops and training sessions which took place throughout the whole organization. The BS department always conducted the sessions' (head of BS department, January 2010).

The management control and the quality management programs/frameworks are, today, completely aligned and the quality management objectives and indicators are visualized in the BSC strategic maps and scorecards, as well as in SIADAP/QUAR and in the annual activities plans/reports.

Commenting on these developments, a top DM manager pointed out:

'Quality management and the implementation of a culture of quality based on international standards of quality, namely TQM, contributed to a strategy of external image and visibility but, above all, introduced the concept of better services to clients as citizens and the involvement of all staff with the ideal of public service. Before 2004, the staff did not answer to clients in a proper way. People are the success key of the organization and they must be fully aligned with the strategy and the goals of IGFSS' (November 2011).

According to this view, the Secretary of State head of office (MSSL) concludes:

'To be efficient and provide effectiveness is very important, but the concept of public service mission is also essential, and to achieve that level, the employees mind must be free and motivated. Today, in Portugal, NPM is still the mainstream, but that is not the reality. A move to NPS is beginning to spread in Europe and IGFSS is an example of this new trend' (September 2011).

The strategy maps were implemented at the three levels of the organizational structure, the corporate level, comprehending the global key indicators and outcomes, the BUs level, and also the individual/staff level. Thus, individual employees are also assessed and can confirm the way they influence the global performance of the organization. A DM manager mentions:

'The new management model is based on the BSC and presents indicators that can measure performance at financial and quality levels. It allows the assessment of the organizational performance. Moreover, the BSC allows the assessment through SIADAP and QUAR, but the framework presents much more data than what is demanded by these regulatory frameworks. The objectives are aligned using the BSC and, thus, deviations are clearly visualized in a way that corrective measures can be taken' (March 2010).

Reinforcing the idea, the BS department head made the following comment:

'This model also implied the implementation of new innovative practices. Moreover, the strategy, the 'vision' and the 'mission' are clarified pointing at quality management – to be an institute leader in the quality of public service. Therefore, quality management indicators can be permanently monitored and TQM is clearly visualized. On the other hand, when IGFSS was certified (ISO 9001 or EFQM awards) the auditors used to mention that our quality manual has specific characteristics which imply that the manual goes further than what is demanded for this kind of certifications' (October 2010).

Regarding quality management and quality outcomes, the organization won several quality awards, in particular EFQM awards (including twice the top Recognized for Excellence 5 star). Moreover, CAF was regularly assessed externally (audited by the Portuguese quality association) in IGFSS from 2004 to 2008. The assessment increased markedly between 2004 and 2008, when 84.4 points (scale 0-100 points) were achieved.

The three year strategic plan identifies the mission, the vision and the main values associated with quality management. The corporate BSC, in a drill-down process, leads the BSC of the several BUs of the organization including a quality perspective. Supporting these proceedings, a well-conceived strategy was implemented in order to fully involve the managers and the staff.

'After the launching of PA reform and, in particular, when CAF and SIADAP appeared, IGFSS saw an opportunity for change and modernization. A new management model was implemented and we established a compromise with quality and with a better service to clients and citizens. An objective was clearly settled: the involvement of all staff with an ideal of public service and with the mission of social security. There is a great sense of responsibility of managers and staff. All employees accede online to results and outcomes, which contributes to their involvement, motivation and satisfaction' ('IGFSS winning change management' video, March 2011).

The communication plan consisted of: i) written and online internal communication; ii) slogans; and iii) discourse and use of language. Whenever necessary, rhetorical strategy was used.

'Internal communication consisted basically of a mix of communication channels such as informative flashes disclosed by email, online intranet, a regular newsletter, daily selection of news in press (regarding the activity of the organization) and messages from the BD (in particular, recognition of success and efficiency results and outcomes). Texts presented in the communication channels and the discourse and language we used were carefully previously conceived. The language used has some power and when it is used by different people it also has different power. Thus, the discourse also intended to convince the managers and staff in general of the potential benefits due to the implementation of the new management model and the innovative management frameworks. We also used very well-conceived slogans, because they remain in people's minds. Our main slogan is "we are going to make it and succeed!". Furthermore, we do things with passion and I guess that is what distinguishes us from the others. Communication was crucial to support the change process' (head of BS department, October 2012).

Complementing the communication plan, the mobilization of allies to support the change process was another important element of the conceived strategy. Accordingly, the BS department head states:

'With respect to allies, beyond the BD and the BS team, we always considered the BU managers as strong allies to the change process. They were responsible for captivating people and teams for change and thus they were the first we had to 'conquer'. Consequently we could count on them to 'sell' the challenge to the whole organization. This strategy was facilitated because I and my colleagues worked before in other departments and we 'knew' very well the organization and the managers throughout the country. Moreover, as the internal communication organizational function was integrated into the BS department, it was much easier to 'reach' managers or employees directly, when necessary' (September 2012).

Resources were used by the BS department when applying the strategy associated with the implementation of the innovative management accounting frameworks. Basically intangible resources were used. Tangible (financial) resources were not significant, mainly because the BSC software was not expensive:

'We used mainly intangible resources, such as: i) internal communication; ii) training and workshops; iii) technical and behavioral competences of the BS team; iv) involvement of staff and sense of pride by working in IGFSS; v) relational marketing' (BS department head, October 2012).

The involvement of the staff in the implementation of the new management model and of the innovative management accounting practices implied the evolution to a collective mobilization. The BS department played a significant role in this involvement:

'The BS department is very dynamic. The department managers and technicians are always present and motivate everyone. They help the managers in practical questions and clarify doubts regarding the management frameworks. The BS department centralizes the process, but they also help in analyzing results and proposing corrective measures. Everyone recognizes their technical merit and empathy. They harmonize, conceal and coalesce. They involve everyone in the process, and always intend to motivate people. The BS department is the 'mirror' of the organization' (a DMLS manager, November 2011).

'The involvement of staff in the change process was spontaneous. People accept change and want to participate. This implied a contagious process. Thus, at a certain point, the process

evolved to a collective process of change. However, firstly inducement was needed in a way to obtain consensus' (head of BS department, October 2012).

The new management guidelines and frameworks were the basis for the change process, implying significant behavioural and cultural changes in the organization. A DMLS manager synthesized this view:

'What happened was a radical cultural change. In the past, we had to produce maps handmade. Only top managers used to accede to accurate data. The organization used to present an activities plan at the beginning of the year and a report at the end of the year. Today, we have all needed data accurately and on time; moreover, data are available to all staff; the management control process is deeply rooted in the organization. A new culture spread through the whole organization. Today, decision-making is much more supported on accurate and on time data. The employees always look to do better and better. I could say we have high motivation and a winning and always improving mentality' (March 2010).

The BS department led the change process with full support of the BD. The BS department triggered the change process, and showed capacity of communication and negotiation, capacity for collective mobilization, power, formal authority and legitimacy to act:

'The BS department always presents ideas and proposals that are never imposed. People must understand the added value that they can obtain. The department has strong capacity of communication and inducement to align, convince, aggregate and build consensus' (BS department middle manager, November 2012).

'The BS team was the leader of the process. I remember that, in seminars and workshops led by the BS department, even when the BD members were not physically present, all of us knew that 'they were there'. The message was clear and the BS department had enough power to negotiate or (if necessary) impose its ideas and strategies' (a DMLS manager, March 2011).

6 Discussion and conclusions

A deep change process occurred in IGFSS, and innovative management accounting and control frameworks and practices were implemented in the organization. Profound changes were found in management. More accurate and on-time data were 'produced', objectives and targets began to be regularly defined and aligned in the organization, indicators were measured in a proper way, and a corrective measures process was implemented duly supporting decision-making. Managers and staff were mobilized and involved in a collective process of change. This convergent change process was implemented as a response from the internal dynamics of IGFSS to pressures and trends visualized at the societal and organizational field levels (Thornton and Ocasio, 1999; Thornton et al., 2012). Consequently, the investigation is informed by the Thornton et al.'s model as a way to explain the change process found in the field site.

At the organization/individual level which is a part of the institutional logics theoretical perspective (Thornton and Ocasio, 1999; Thornton et al., 2012), institutional logics were found as a response to pressures and trends identified at the upper field levels. Concretely, three multiple logics are visualized in the study.

The first set of multiple logics integrates the 'public administration mode' logics, identified at the societal level. Evidence shows that three competing logics characterize administration of government agencies, PA, NPM and NPG/NPS. In the period of ten years under analysis covering the longitudinal case study, IGFSS responded to the demands of the societal level. These competing logics evolved from PA to NPM, when IGFSS implemented CAF and the quality program and complied with the management contracts. Later, when the organization directed its main goals and identities to the accomplishment of public service, a transition occurred and NPG/NPS appeared as an 'umbrella' guiding the new management and culture, as the current Secretary of State (MSSL) head of office stated. These logics follow an evolution over time. Today, the prevailing logic seems to be NPG/NPS (defying or dominant – Besharov and Smith, 2014; Pache and Santos, 2013a) but, following Wiesel and Modell (2014) conclusions, the result could be a combination or alignment of the two logics (Besharov and Smith, 2014; Pache and Santos, 2013a).

The second set of multiple logics are the 'compliance' logics. This set of logics is not characterized as a transition. Indeed, the organization implemented innovative management accounting frameworks and practices as a response to demands from the organizational field level. Particularly IGFSS implemented a BSC, a quality programme and a strategic plan that allowed a full response to compulsory demands by law, particularly SIADAP /QUAR and the management contracts. This perspective allows the identification of 'compulsory' logics. However, findings indicate that the organization responded more broadly to those demands, encompassing the 'production' of outcomes in the frameworks that went much further than what was demanded. Moreover, CAF was implemented in a very efficient way, being a very useful framework for the new management model. CAF was not compulsory but a recommendation from the organizational field level. Thus, response to CAF challenge and response that went further than what was demanded are the 'voluntarism' logic. These two logics (compulsory and voluntarism) form the second set found in the field site - 'compliance' logics. They are not competing logics. In the organization, coexistence is visualized because social actors responded accurately to both demands. This type of logic response is not to be found in existing literature.

The third set of multiple logics are 'management' logics. A transition occurred in the organization when IGFSS moved from a situation where data were neither accurate nor available on time, and not available to all managers, to a situation where data were accurate, available on time, and allowing the operation of a management control process. Before the change process, data were not efficient and did not allow the implementation of an informed decision-making process. Oppositely, after the change process, data were efficient in a proper way to be used in a decision-making process. The first situation implies a 'non-informed decision-making' logic. The second situation shows an 'informed decision-making' logic, characterized by a response to the organizational field level, the implementation of an appropriate management model, in order to match the demands of EFQM awards, CAF, SIADAP/QUAR, or the management contracts. This third set of logics ('management' logics) is different from the previous ones because the 'non-informed decision-making' logic does not result from responses to the upper field logics. However, the characteristics of institutional logics and multiple logics 'are there'. The 'informed decision-making' logic is a defying logic (Pache and Santos, 2013a), which turns into a dominant logic (Besharov and Smith, 2014).

The visualization of these three different sets of multiple logics in the organization, as a response to demands from the upper field levels, is a contribution of the study. Some of the

identified logics are categorized following previous literature, but others were not to be found in existing literature.

Informing the empirical study with the Thornton et al.'s model, most of the elements and processes of the model were found in the field site. Looking first at the main elements of the model (culture, focus of attention, and social identities, goals, and schemas), several situations are found that contribute to support the conclusion that the Thornton et al.'s model explains mostly the change process which occurred in IGFSS. This is another contribution of the investigation, answering research question number two. Culture at the societal (macro) level (world culture) is clearly found in the study, particularly the guidelines and principles from Al Gore report (1993), the OECD report (1986), and the Lisbon strategy (2000). PAR and CAF explain the visualization of culture at the organizational field level. But culture was also a key element for the successful change process at the organization level, when the organization implemented an overall new management model and innovative management accounting frameworks. Involvement of all staff, mobilization, the quality program and the 'production' of accurate data complemented the cultural elements at the organization level. Moreover, recursive action based on culture was seen, when other ministries and some municipalities intended to adopt similar frameworks.

Focus of attention was also very much seen in the study, particularly when the head of the BS department took the initiative in proposing the implementation of a BSC, acting also as an institutional entrepreneur (showing a strong inducement power and triggering the change process). The well-conceived strategy launched by the BS department (with full support of the BD) was characterized by the implementation of a communication plan, by motivation of others, by mobilization of allies, by the use of language discourse and rhetorical strategies. These actions focused the attention of the social actors directed to decision-making.

Social identities, goals and schemas were visualized in the change process of IGFSS within a wide scope. The new management model implied the identification of goals and the assessment of all staff of the organization. Everybody knows their influence on performance. All employees participated in the process, are fully aligned with the strategy and goals, and accede online to results and outcomes, using widespread schemas. The communication channels that make everyone 'inside the business', discourse, language and slogans, and the permanent help of the BS department also contributed to highlight the influence of these mechanisms.

With respect to processes/perspectives and mechanisms that allow the linkage of the several elements of the model and the effectiveness of the cross-level effects that compose the Thornton et al.'s model, they were mostly found in IGFSS. Salience is seen when social actors respond to certain demands from the environment in a more extent than others. Availability and accessibility of data and outputs of the management model spread throughout the whole organization. The interaction of actors with other social actors possessing different grades of power implies the occurrence of activation. The decisions taken by social actors regarding communication, negotiation and mobilization with other social actors also facilitate activation.

Collective mobilization was a determinant process (integrated into the well-conceived strategy) to the implementation of the change process. The organizational behavior of managers and staff in general was influenced by the global sensemaking that spread throughout the whole organization. Consequently, decision-making encompassing the global

management model was accurate and effective. Very important was also the decision-making process informing the strategy for the implementation of new and innovative management accounting frameworks. To this end, the use of language, discourse and rhetorical strategies was crucial. Finally, communication strategies and negotiation (which was sometimes used to mobilize allies), were also significant mechanisms for the achievement of the change process.

The key elements that influence the change process and the implementation of the innovative management accounting frameworks and practices are seen in Figure 3. Institutional (multiple) logics are visualized at the societal (macro) and organizational field (meso) levels because they relate do demands and not to responses from the organization (micro) level. The three nested levels identified in the institutional logics perspective are visualized. Culture is seen in all three levels, and top-down moves occur from the societal level to the organizational field level and then to the organization level. Besides, culture acts in a recursive way by influencing culture at the organizational field level, when other ministries and municipalities followed IGFSS process for the implementation of innovative frameworks (CAF/TQM in particular).

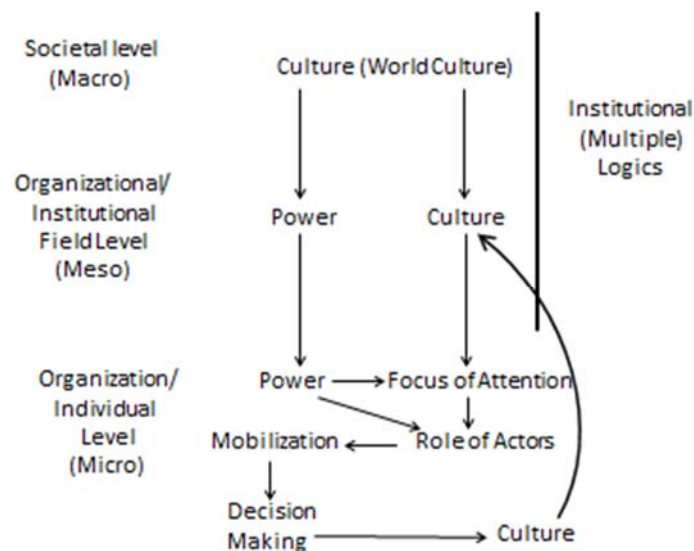


Figure 3: Key elements found in the field site, integrated into the interinstitutional system and the cross-level effects

Culture influences power at the meso level (CAF influenced the quality program in ministries in Portugal) and power is a key element, influencing power at the micro level (the implementation of the innovative frameworks with support of the ministry and the BD). Power at the micro level influences directly the focus of attention of social actors translated into their role as the main trigger agents in the change process (basically the BS department and its head, acting as institutional entrepreneurs). These actors used a well-conceived strategy, mobilizing allies and involving all staff in the organization. This strategy strongly influenced decision-making in the organization (management control was appropriately implemented, supporting accurately decision-making) and, in a very significant way, organizational culture (which was the basis for the radical change seen in the organization).

Figure 3 shows the main elements and mechanisms found in practice that explain the change process which occurred in IGFSS after 2003/2004. Evidence showed that the most significant elements/mechanisms, having a strong impact on the successful implementation of innovative management accounting practices, were organizational culture, power and the role of actors. This discussion follows Scapens (1994) challenge, by encouraging researchers to look in-depth at management accounting practices, and not to dismiss practices which do not conform to mainstream. The diagram presented in Figure 3 is another contribution of the study, answering research question number one. Concretely, “the research has followed practice – with researchers seeking to understand and theorize what practitioners do and how practices evolve. The challenge for the future is to use this theoretical informed understanding to provide insights which are relevant and useful for practitioners; for management accounting research to have more of an impact on practice” (Scapens, 2006: 28).

Some of the elements visualized in Figure 3 are not included in the Thornton et al.’s model. These elements are synthetically culture (at the organizational/micro level), power and the role of actors. Figure 4 presents the Thornton et al.’s model including these elements, which are seen in bold. The processes/perspectives associated with the cultural influences on other levels in a top-down or bottom-up sequences are also visualized.

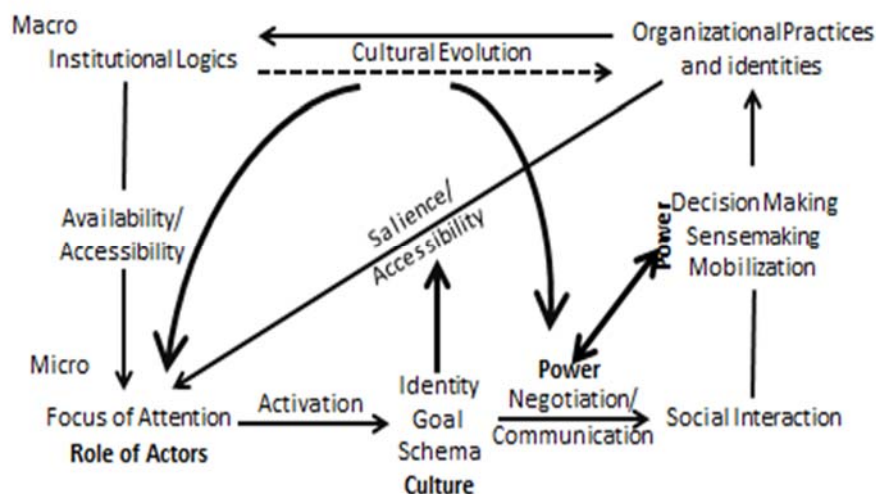


Figure 4: Impact of new elements in the Integrative Model of the Microfoundations of Institutional Logics

References

- Alford, R.R. and R. Friedland (1985), *Powers of Theory: Capitalism, the State, and Democracy*, Cambridge: Cambridge University Press.
- Battilana, J., B. Leca and E. Boxenbaum (2009), How actors change institutions: Towards a theory of institutional entrepreneurship, *The Academy of Management Annals* 3(1), 65-107.
- Besharov, M.L. and W.K. Smith (2014), Multiple institutional logics in organizations: Explaining their varied nature and implications, *Academy of Management Review*, 39(3), 364-381.
- Bourdieu, P. (1977), *Outline of a Theory of Practice*. Cambridge, MA: Cambridge University Press.

- Bourdieu, P. (1990), *The Logic of Practice*. Stanford, CA: Stanford University Press.
- Child, J. (1972), Organizational structure, environment and performance: The role of strategic choice, *Sociology*, 6, 1-22.
- Christensen, S., P. Karnoe, J.S. Pederson and F. Dobbin (1997), Actors and institutions: editors' introduction, *American Behavioral Scientist* 40, 392-396.
- Clegg, S.R. (1989), *Frameworks of Power*. London: Sage.
- Clegg, S.R. (2009), Managing power in organizations: The hidden history of its constitution, in Clegg, S.R. and M. Haugaard (Eds.), *The Sage Handbook of Power*, London: Sage, 310-331.
- Clegg, S.R., D. Courpasson, and N. Philips (2006), *Power and Organizations*. Thousands Oaks, CA: Sage.
- Cooper, D.J., M. Ezzamel and H. Willmott (2008), Examining 'institutionalization': A critical theoretical perspective, in Greenwood, R., C. Oliver, K. Sahlin and R. Suddaby (Eds.), *The Sage Handbook of Organizational Institutionalism*, Thousands Oaks, CA: Sage, 673-701.
- Cruz, I., M. Major and R.W. Scapens (2009), Institutionalization and practice variation in the management control of a global/local setting, *Accounting, Auditing and Accountability Journal* 22, 91-117.
- Cruz, I., R.W. Scapens and M. Major (2011), The localization of a global management control system, *Accounting, Organizations and Society* 36(7), 412-427.
- Dacin, M.T., J. Goodstein and W.R. Scott (2002), Institutional theory and institutional change: Introduction to the special research forum, *Academy of Management Journal* 45(1), 45-57.
- Denhardt, R.B. and J.V. Denhardt (2000), The new public service: serving rather than steering, *Public Administration Review* 60(6), 549-559.
- Dillard, J., J. Rigsby and C. Goodman (2004), The making and remaking of organization context: Duality and the institutionalization process, *Accounting, Auditing and Accountability Journal* 17(4), 506-542.
- DiMaggio, P. (1988), Interest and agency in institutional theory, in L. Zucker (Ed.), *Institutional Patterns and Organizations*, Cambridge, MA: Ballinger, 3-22.
- DiMaggio, P.J. (1991), Constructing an organizational field as a professional project: U.S. art museums, 1920-1949, in Powell, W.W. and P.J. DiMaggio (Eds.), *The New Institutionalism in Organizational Analysis*, Chicago, IL: The University of Chicago Press, 267-292.
- DiMaggio, P.J. (1997), Culture and cognition, *Annual Review of Sociology*, 23, 263-287.
- DiMaggio, P.J. and W.W. Powell (1983), The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields, *American Sociological Review* 48(2), 147-160.
- Drori, G.S. (2008), Institutionalism and globalization studies, in Greenwood, R., C. Oliver, K. Sahlin and R. Suddaby (Eds.), *The Sage Handbook of Organizational Institutionalism*, Thousands Oaks, CA: Sage, 449-472.
- EIPA, 2013, EIPA – Topics / CAF – Common Assessment Framework., www.eipa.eu/CAF (consulted in 2013.02.25).
- Ezzamel, M., K. Robson and P. Stapleton (2012), The logics of budgeting: Theorization and practice variation in the educational field, *Accounting, Organizations and Society* 37, 281-303.
- Fitzgerald, L. (2007), Performance measurement, in Hopper, T., D. Northcott, and R. Scapens (Eds.), *Issues in Management Accounting* (3rd edition), Edinburg Gate: Pearson Education, 223-241.
- Fligstein, N. (1987), The interorganizational power struggle: The rise of finance personnel to top leadership in large corporations, 1919-1979, *American Sociological Review*, 52, 44-58.
- Fligstein, N. (1997), Social skill and institutional theory, *American Behavioral Scientist* 40(4), 397-405.
- Fligstein, N. (2001), Social skill and the theory of fields, *Sociological Theory* 19(2), 105-125.

Friedland, R. and R. Alford (1991), Bringing society back in: Symbols, practices and institutional contradictions, in Powell, W.W. and P.J. DiMaggio (Eds.), *The New Institutionalism in Organizational Analysis*, Chicago, IL: The University of Chicago Press, 232-263.

Garud, R., S. Jain and A. Kumaraswamy (2002), Institutional entrepreneurship in the sponsorship of common technological standards: The case of Sun Microsystems and Java, *Academy of Management Journal* 45(1), 196-214.

Gore, Al (1993), *Creating a Government that Works Better and Costs Less: The Report of the National Performance Review*. New York: Plume.

Greenwood, R. and R. Suddaby (2006), Institutional entrepreneurship in mature fields: The big five accounting firms, *Academy of Management Journal* 49(1), 27-48.

Greenwood, R., C. Oliver, K. Sahlin and R. Suddaby (2008), Introduction, in Greenwood, R., C. Oliver, K. Sahlin and R. Suddaby (Eds.), *The Sage Handbook of Organizational Institutionalism*, Thousands Oaks, CA: Sage, 1-46.

Hardy, C. and S.R. Clegg (1996), Some dare call it power, in Clegg, S.R., C. Hardy and W.R. Nord, *Handbook of Organization Studies*, London: Sage, 622-641.

Hardy, C. and S. Maguire (2008), Institutional entrepreneurship, in Greenwood, R., C. Oliver, K. Sahlin and R. Suddaby (Eds.), *The Sage Handbook of Organizational Institutionalism*, Thousands Oaks, CA: Sage, 198-217.

Hargrave, T.J. and A.H. Van de Ven (2006), A collective action model of institutional change, *Academy of Management Review* 31(4), 593-627.

Haugaard and Clegg, 2009, Introduction: Why power is the central concept of the social sciences, in Clegg, S.R. and M. Haugaard (Eds.), *The Sage Handbook of Power*, London: Sage, 1-24.

Haveman, H.A. and H. Rao (1997), Structuring a theory of moral sentiments: Institutional and organizational coevolution in the early thrift industry, *American Journal of Sociology*, 102, 1606-1651.

Hinings, C.R., R. Greenwood, T. Reay and R. Suddaby (2004), Dynamics of change in organizational fields, in Poole, M.S. and A.H. Van de Ven (Eds.), *Handbook of Organizational Change and Innovation*, New York: Oxford University Press, 304-323.

Hood, C. (1995), The "new public management" in the 1980's: Variations on a theme, *Accounting, Organizations and Society* 20(2/3), 93-109.

Hopper, T. and M. Major (2007), Extended institutional analysis through theoretical triangulation: Regulation and activity-based costing in Portuguese telecommunications, *European Accounting Review* 16(1), 59-97.

Hopper, T., D. Northcott and R. Scapens (Eds.) (2007), *Issues in Management Accounting* (3rd edition). Edinburg Gate: Pearson Education.

Jackall, R. (1988), *Moral Mazes, The Word of Corporate Managers*, New York: Oxford University Press.

Johnson, H.T. and R.S. Kaplan (1991), *Relevance Lost: The Rise and Fall of Management Accounting* (2nd edition), Boston, MA: Harvard Business School Press.

Lawrence, T. B. (2008), Power, institutions and organizations, in Greenwood, R., C. Oliver, K. Sahlin and R. Suddaby (Eds.), *The Sage Handbook of Organizational Institutionalism*, Thousands Oaks, CA: Sage, 170-197.

Lawrence, T. and N. Philips (2004), From Moby Dick to Free Willy: Macro-cultural discourse and institutional entrepreneurship in emerging institutional fields, *Organization* 11(5), 689-711.

Lawrence, T.B., R. Suddaby and B. Leca (2011), Institutional work: Refocusing institutional studies of organization, *Journal of Management Inquiry*, 20: 52-58.

Leca, B. and P. Naccache (2006), A critical realist approach to institutional entrepreneurship, *Organization* 13(5), 627-651.

Leca, B., J. Battilana and E. Boxenbaum (2008), Agency and institutions: a review of institutional entrepreneurship, *Working Paper 08-096*, Harvard Business School.

- Levy, D. and M. Scully (2007), The institutional entrepreneur as Modern Prince: The strategic face of power in contested fields, *Organization Studies* 28(7), 971-991.
- Lounsbury, M. (2001), Institutional sources of practice variation: Staffing college and university recycling programs, *Administrative Science Quarterly* 46, 29-56.
- Lounsbury, M. (2002), Institutional transformation and status mobility: The professionalization of the field of finance, *Academy of Management Journal*, 45, 255-266.
- Lounsbury, M. (2007), A tale of two cities: Competing logics and practice variation in the professionalizing of mutual funds, *Academy of Management Journal* 50(2), 289-307.
- Lounsbury, M. (2008), Institutional rationality and practice variation: New directions in the institutional analysis of practice, *Accounting, Organizations and Society* 33, 349-361.
- Lounsbury, M. and E. Boxenbaum (2013), Institutional logics in action, , *Research in the Sociology of Organizations*, 39A, 3-22.
- Lounsbury, M. and L.T. Crumley (2007), New practice creation: An institutional perspective on innovation, *Organization Studies* 28(7), 993-1012.
- Maguire, S. and C. Hardy (2006), The emergence of new global institutions: A discursive perspective, *Organization Studies* 27(1), 7-29.
- Maguire, S., C. Hardy and T.B. Lawrence (2004), Institutional entrepreneurship in emerging fields: HIV/AIDS treatment advocacy in Canada, *Academy of Management Journal* 47(5), 657-679.
- Martin, J. and P. Frost (1996), The organizational culture war games: A struggle for intellectual dominance, in in Clegg, S.R., C. Hardy and W.R. Nord, *Handbook of Organization Studies*, London: Sage, 599-621.
- Meyer, J.W. and B. Rowan (1977), Institutionalized organizations: Formal structure as myth and ceremony, *American Journal of Sociology* 83, 340-363.
- Miles, M.B. and A.M. Huberman (1994), *Qualitative Data Analysis* (2nd edition). Thousands Oaks: Sage.
- Ministério da Segurança Social e do Trabalho (Ministry of Social Security and Labor) (2004), *Programa Qualidade do Ministério da Segurança Social e do Trabalho – Um Modelo Integrado de Aplicação da CAF (Quality Programme - Ministry of Social Security and Labor – An Integrated Model of CAF Application)*. Lisboa.
- Ocasio, W. (1997), Towards an attention-based view of the firm, *Strategic Management Journal*, 18, 187-206.
- Ocasio, W. (2011), Attention to attention, *Organization Science*, 22(5): 1286-1296.
- Ocasio, W., J. Loewenstein and A. Nigam (2015), How streams of communication reproduce and change institutional logics: The role of categories, *Academy of Management Review*, 40(1), 28-48.
- Oliver, C. (1991), Strategic responses to institutional processes, *Academy of Management Review*, 16, 145-179.
- Osborne, S.P. (2006), The new public governance, *Public Management Review* 8(3), 377-387.
- Pache, A.C. and F. Santos (2013a), Embedded in hybrid contexts: How individuals in organizations respond to competing institutional logics, *Research in the Sociology of Organizations*, 39B, 3-35.
- Pache, A.C. and F. Santos (2013b), Inside the hybrid organizations: Seletive coupling as a response to competing institutional logics, *Academy of Management Journal*, 56(4), 972-1001.
- Pfeffer, J. and G.R. Salancyk (1978), *The external control of organizations: A resource dependence perspective*. New York: Harper and Row.
- Philips, N. and C. Hardy (2002), *Discourse analysis: Investigating processes of social construction*. Thousands Oaks, CA: Sage.
- Philips, N., T.B. Lawrence and C. Hardy (2004), Discourse and institutions, *Academy of Management Review* 29(4), 635-652.

- Pollitt, C. (2009), Bureaucracies remember, post-bureaucratic organizations forget?, *Public Administration* 87(2), 198-218.
- Powel, W.W. and J.A. Colyvas (2008), Microfoundations of institutional theory, in Greenwood, R., C. Oliver, K. Sahlin and R. Suddaby (Eds.), *The Sage Handbook of Organizational Institutionalism*, Thousands Oaks: Sage, 276-298.
- Purdy, J.M. and B. Gray (2009), Conflicting logics, mechanisms of diffusion, and multilevel dynamics in emerging institutional fields, *Academy of Management Journal*, 52, 355-380.
- Ribeiro, J.A. and R.W. Scapens (2006), Institutional theories and management accounting change: Contributions, issues and paths for development, *Qualitative Research in Management and Accounting* 3(2), 94-111.
- Ryan, B., R.W. Scapens and M. Theobald (2002), *Research Method and Methodology in Finance and Accounting* (2nd edition). London: Thomson.
- Scapens, R.W. (1990), Researching management accounting practice: The role of case study methods, *British Accounting Review* 22, 259-281.
- Scapens, R.W. (1994), Never mind the gap: Towards an institutional perspective of management accounting practices, *Management Accounting Research* 5(3-4), 301-321.
- Scapens, R.W. (2006), Understanding management accounting practices: A personal journey, *The British Accounting Review* 38, 1-30.
- Scott, W.R. (1995), *Institutions and Organizations* (1st edition). Thousands Oaks, CA: Sage.
- Scott, W.R. (2013), *Institutions and Organizations: Ideas and Interests and Identities* (4th edition). Thousands Oaks, CA: Sage.
- Scott, W.R., M. Rueff, P. Mendel, and C.A. Caronna (2000), *Institutional Change and Healthcare Organizations: From Professional Dominance to Managed Care*. Chicago: University of Chicago Press.
- Seo, M.G. and W.E.D. Creed (2002), Institutional contradictions, praxis, and institutional change: A dialectical perspective, *Academy of Management Review* 27(2), 222-247.
- Staes, P. and N. Thijs, (Eds.) (2010), *Growing towards excellence in the European public sector – A decade of European collaboration with CAF*. EIPA, Belgian Presidency of the Council of the European Union.
- Stinchcombe, A.L. (2002), New sociological microfoundations for organizational theory: A postscript, *Social Structures and Organizations Revisited, Research in the Sociology of Organizations*, 19, 415-433.
- Suddaby, R. and R. Greenwood (2005), Rhetorical strategies of legitimacy, *Administrative Science Quarterly* 50(1), 35-67.
- Swidler, A. (1986), Culture in action: Symbols and strategies, *American Sociological Review*, 51, 273-286.
- Thornton, P. H. (2004), *Markets from culture: Institutional Logics and Organizational Decisions in Higher Education Publishing*, Stanford, CA: Stanford university Press.
- Thornton, P. H. and W. Ocasio (1999), Institutional logics and the historical contingency of power in organizations: Executive succession in the higher education publishing industry, 1958-1990, *American Journal of Sociology*, 105, 801-843.
- Thornton, P.H. and W. Ocasio, (2008), Institutional logics, in Greenwood, R., C. Oliver, K. Sahlin and R. Suddaby (Eds.), *The Sage Handbook of Organizational Institutionalism*, Thousands Oaks: Sage, 99-129.
- Thornton, P.H., W. Ocasio and M. Lounsbury (2012), *The Institutional Logics Perspective: A New Approach to Culture, Structure, and Process*. Oxford, UK: Oxford University Press.
- Tolbert, S. and L.G. Zucker (1983), Institutional sources of change in the formal structure of organizations: the diffusion of civil service reform, 1880-1935, *Administrative Science Quarterly* 28(1), 22-39.

Wickramasinghe, D. and C. Alawattage (2007), *Management Accounting Change: Approaches and Perspectives*. Oxon: Routledge.

Wiesel, F. and S. Modell (2014), From new public management to new public governance? Hybridization and implications for public sector consumerism, *Financial Accountability and Management*, 30(2014),

Yin, R.K. (2014), *Case Study Research: Design and Methods* (5th edition). Thousands Oaks, CA: Sage.

Zilber, T.B. (2007), Stories and the discourse dynamics of institutional entrepreneurship: the case of Israeli high-tech after the bubble, *Organization Studies* 28(7), 1035-1054.

Zilber, T.B. (2008), The work of meanings in institutional processes and thinking, in Greenwood, R., C. Oliver, K. Sahlin and R. Suddaby (Eds.), *The Sage Handbook of Organizational Institutionalism*, Thousands Oaks, CA: Sage, 151-169.

Zucker, L.G. (1977), The role of institutionalization in cultural persistence, *American Sociological Review* 42, 726-743.

Zucker, L.G. (1991), Postscript: microfoundations of institutional thought, in. Powell, W.W. and P.J. DiMaggio (Eds.), *The New Institutionalism in Organizational Analysis*, Chicago, IL: The University of Chicago Press, 103-107.

Appendix 1

IGFSS Interviews

<u>Date</u>	<u>Length</u>	<u>Nº Interviews</u>	<u>Interviewees</u>
1st quarter 2010	30h 40m (from 40m to 1h 55m)	21	BS manager (3 interviews); BS middle manager (2 interviews); DMLS manager 1 (2 interviews); RE technician (2 interviews); DM technician; BA technician; FM manager; BA manager; RE manager; DMLS manager 2; DMLS manager 3; TS manager; DM manager1; DMLS manager 4; DMLS manager 5; DMLS manager 6.
2nd quarter 2010	3h 20m (from 50m to 1h 35m)	3	TS technician; BS manager; Quidgest (supplier) technician.
FIRST PHASE (PILOT STUDY):		34h 00m	24 interviews
4th quarter 2010	8h 30m (from 55m to 1h 55m)	6	BS middle manager (2 interviews); BS manager; Member of board; Member of board (Vice President); Member of IPSG 1 and QPG.
1st quarter 2011	5h 15m (from 1h to 2h)	4	Former minister MSSL; Former member of board 1; Member of EUQSG and QPG (MSSL); HR manager and previous member of QPG.
2nd quarter 2011	55m	1	Former member of board 2.
SECOND PHASE (MAIN STUDY):		14h 40m	11 interviews
3rd quarter 2011	1h 10m	1	Secretary of State manager of office (MSSL).
4th quarter 2011	9h 30m (from 30m to 1h 40m)	8	President; Former minister MSSL; DMLS manager 2; DMLS manager 3; DMLS manager 7; DMLS manager 8; DMLS manager 9; RE Manager/RE Technician.
1st quarter 2012	4h 0m (from 50m to 2h 150m)	3	DM manager 2; Former minister permanent secretary (MSSL); Member of IPSG 2 and coordinator of QPG.
THIRD PHASE (MAIN STUDY):		14h 40m	12 interviews
TOTAL		63h 20m	47 interviews

BA-Budget and accounting department; BS-Board support department; DM-Debt management department; DMLS-Debt management department/local services; FM-Financial management department; HR-Human resources department; IPSG-Innovative Public Services Group; MSSL-Ministry of Social Security and Labor; QPG-Quality Programme Group; RE-Real estate department; TS-Technical support department

Business Model Innovation for Industry 4.0

Maria do Rosario Cabrita and José Maria Viedma

The term “Industry 4.0”, has become a widely used synonym for the rise of a new digital industrial technology and cyber physical systems that enable many innovative functionalities through their networking and their access to the cyber world, thus changing the way we live, think, and relate each other. In this context, new business models, work processes and business operations development that are currently unimaginable will arise. These changes will also influence the society, and the entire structure of the world economy. Industry 4.0 demands more than just a technology-based approach: a thorough rethinking of companies’ value chain and value proposition is required, since established business models may no longer guarantee successful performance. Papers in this stream aim to deepen the understanding of Industry 4.0 and its challenges and opportunities for the emerging business models. They contribute to business model innovations in the context of Industry 4.0.

Does Industry 4.0 require Business Model Innovation?

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Abstract: The term “Industry 4.0” has become an increasingly popular in the last few years due to recent developments in cyber-physical systems, big data, cloud computing, and industrial wireless networks. Intelligent manufacturing has produced a revolutionary change in our day-to-day life providing new opportunities. At the same time, organizations face the difficulties doing the business when well-known practices and tools are not suitable anymore or do not ensure expecting results. Thus, the necessity to new business models accounting for current phase of economic development occurs. Business model is one of important things in business activities and in new industrial and market requirements. The purpose is to study the concept of “Industry 4.0” and analyze approaches to business model design in the digitalization era to understand the gap between theory and practice and determine the future ways of research. The literature review was carried out using the main scientific literature databases, journal articles, conference papers, books and other documentation, as the source of the secondary data. Due to the fact that business models are specific for each company, it’s difficult to assemble all approaches. We may find just aggregate directions. But this paper may be useful to scholars and managers who are interesting in topic of business model design.

Keywords: Industry 4.0, Business Models, Business Models design

1. Introduction

The term “Industry 4.0” has become an increasingly popular in the last few years. From 2005 to 2006, the number of published articles in the Scopus and Google Scholar databases increased drastically, from around 100 to 150; from 2007 to 2014, the number then increased at a stable rate. A significant growth appeared from 2014 to 2015 when 225 documents being published in 2015. China, the United States, and the United Kingdom are the top of countries that are active in this field (Zhong *et al.*, 2017).

Often “Industry 4.0” compares with three industrial revolutions that occurred in the last centuries and that has provided the significant disruptive changes in manufacturing and has led from several technological advances. The adoption of new technologies is fundamental to the development of more intelligent manufacturing processes, which includes devices, machines, production modules and products that are able to independently exchange information, trigger actions and control each other, enabling an intelligent manufacturing

environment (Schuh *et al.*, 2013). Industry 4.0 holds a huge potential and it will provide a set of economic and social opportunities through the paradigm shift regarding to work organization, business models and production technology (Kagermann, 2013).

2. Concept of Industry 4.0

Industry 4.0 is mainly used to refer to the development of “cyber-physical system (CPS) and dynamic data processes that use massive amounts of data to drive smart machines” (Sirkin *et al.*, 2015). Talking about Industry 4.0 we usually mean the digital industry such as the Internet of Things or IoT, big data and analytics or BDA, robotics, and additive manufacturing (3-D printing). Cost reduction and improvements in reliability of many digital technologies lead to their deployment for industrial applications for commercial usage. In Industry 4.0 framework, everything in manufacturing environment is integrated, autonomously exchanging information, triggering action and controlling each themselves independently, which allow the creation of smarter processes (Weyer *et al.*, 2015).

Potentially, Industry 4.0 may bring about a change from isolated manufacturing activities to automated, optimized and fully integrated product and data flows within (global) value chains.

It enables all physical processes and information flows to be available when and where they are needed across holistic manufacturing supply chains, multiple industries, small and medium-sized enterprises (SMEs), and large companies (Wan *et al.*, 2017; Wang *et al.*, 2016). Intelligent manufacturing requires certain underpinning technologies in order to enable devices or machines to vary their behaviors in response to different situations and requirements based on past experiences and learning capacities (McFarlane, 2003). These technologies enable direct communication with manufacturing systems, thereby allowing problems to be solved and adaptive decisions to be made in a timely fashion.

Posada *et al.* (2015) sum up and outline the key aspects addressed by Industry 4.0: (1) the products mass customization enabled by the use of IT, (2) the automatic and flexible adaptation of production systems for changing requirements, (3) the tracking and self-awareness of parts and products and their capability to communicate within their environment, (4) the improved human machine interface, the coexistence with robots and the emergence of new ways of interaction and operation, (5) the communication within the smart factory and the production optimization enabled by Internet of Things and (6) the emergence of new services and business models, influencing the whole value chain.

Industry 4.0 includes some key technologies such as IoT, BDA, robotics, and additive manufacturing etc.

2.1 IoT

IoT is a new pattern that is rapidly rising in the modern economics with a high impact on several aspects of life such as transportation and logistics, healthcare, personal life domain and smart cities, emergency management. In general, IoT is able to offer advanced

connectivity of physical objects, systems, and services, enabling object-to-object communication and data sharing (Zhong *et al.*, 2017).

IoT describes “the interconnection of objects or ‘things’ for various purposes including identification, communication, sensing, and data collection” (Oriwoh *et al.*, 2013, p. 122). In particular, it consists of an infrastructure that is able to measure, identify, track, and monitor objects for connecting things, sensors, actuators, and other smart technologies (Uckelmann *et al.*, 2011) as well as simplifying people's lives through tasks automation (Espada *et al.*, 2011).

Research has reported on the potential influences of IoT applications on existing value chains and opportunities for new BMs (e.g., Solima *et al.*, 2016), offering some systematic literature reviews on links of IoT and BM (e.g. Kiel *et al.*, 2016; Wnuk and Murari, 2016). In particular, Dijkman *et al.* (2015) by presenting a BM framework for IoT applications showed that BMs has ways to create value for IoT technology that are needed.

2.2 Big data and analytics

The collection and comprehensive evaluation of data from many different sources production equipment and systems as well as enterprise and customer-management systems will become standard to support real-time decision making (Rüßmann *et al.*, 2015).

Economy will continue to move to the customization because customers will become more involved in global value chains as providers of key information and feedback of products. Relationships between firms and customers will be redefined in many ways as BDA allows the possibility to test, in advance, new products and services on clients located anywhere in the world, and to increasingly customise the firm offer to reduce development, launch and adaptation costs (Strange R. & Zucchella, A., 2017).

There are two major points for corporate success in using the BDA. Firstly, successful firms will require a variety of technical and governance capabilities to analyze and implement that data to realize the potential benefits (Davenport *et al.*, 2012; McAfee and Brynjolfsson, 2012; Constantiou and Kallinilos, 2015; Henke *et al.*, 2016). Secondly, individuals’ privacy will be at risk by widespread big data application. Therefore, for organizations and manufacturers with an abundance of operational and shop-floor data, advanced analytics techniques are critical for uncovering hidden patterns, unknown correlations, market trends, customer preferences, and other useful business information (Zhong *et al.*, 2017).

2.3 Robotics

Robots are becoming more autonomous, flexible, and cooperative day by day and at certain they will interact with one another and work safely side by side with humans and learn from them (Rüßmann *et al.*, 2015).

2.4 Additive manufacturing (3-D printing)

With Industry 4.0, additive-manufacturing methods will be widely used to produce small batches of customized products that offer construction advantages, such as complex,

lightweight designs. High-performance, decentralized additive manufacturing systems will reduce transport distances and stock on hand (Rüßmann *et al.*, 2015).

Industry 4.0 will lead to potential deep changes in several domains that go beyond the industrial sector. Its impacts and influence can be categorized into six main areas:

1) Industry. Due to the development of new technologies manufacturing is characterized by decentralized and digitalized production with fully integrated and complex products and processes and shifting the production vision from mass production to mass customization. Therefore, the production processes and operations will be deeply affected by the technological developments and the establishment of smart factories, allowing a greater flexibility in operations and a more efficient resource allocation (Pereira and Romero, 2017). The fourth industrial revolution affects not only productivity but also the whole supply chain from product development and engineering processes to outbound logistics.

2) Products and services. Real customers want more complex and smarter products and services to satisfy their needs. The products will become more modular and configurable, promoting mass customization in order to meet specific customer requirements (Jazdi, 2014) and become responsive and interactive, being able to be managed and track their activity in real-time, optimizing the whole value chain and providing relevant information about their status during their lifecycle (Kagermann *et al.*, 2013).

3) Business models and market. Due to the opportunity of Industry 4.0 to provide the integration between manufactures and customers, the value chains become more responsive. Thus, business models adapt easily and faster to the market requirements. The systems integration and complexity alongside the increasing digitization of industrial production will lead to the creation of more complex and digital market models (Zezulka *et al.*, 2016), increasing competitiveness through the elimination of barriers between information and physical structures (Pereira and Romero, 2017).

4) Economy. New technologies provide new markets, new players and new development.

5) Work environment. The implementation of new technologies, products and services will have an impact on job profiles and will require new approaches on organization, planning and management of working area. The main challenge in this context is to avoid technological unemployment.

6) Skills development. Industry 4.0 requires new skills and competencies and it is necessary to create opportunities for the acquisition of the required skills through high quality education process. The new required competency fields need to be included in education, since interdisciplinary thinking will play an important role and excellent skills in social and technical domains will be sought for (Magruk, 2016).

Manufacturing does not need to be centralized but may be undertaken close to the end-users, with the consequent savings in delivery times and transportation costs and reduced international flows of intermediate goods and services. Most raw materials are readily available from multiple suppliers in most countries. Hence supply chain risk is minimized (Strange & Zucchella, 2017).

The extensive implementation of the digital technologies provides the transformation of the location and organization of manufacturing production worldwide and require new business models.

3. Business Model

It is no doubt anymore that Industry 4.0 brings business organization closer together. The nature and strength of contacts between those organizations gains significant importance, also because nowadays the industry structure is highly distributed among a large number of companies (Paulus-Rohmer *et al.*, 2016). To be successful the business organizations use more or less the same technologies and tools provided by Industry 4.0. At the same time, the way of using and approaches to reach goals may be different. This is where business models come into play.

Literature review shows us that business model has become increasingly popular over the last 20 years. Business models describe the way a company creates, delivers and assimilates value (Osterwalder & Pigneur, 2010), and defines how business should be conducted, for example in terms of strategy, customer relations, market segments and value creation mechanisms (Kans & Ingwald, 2016). There are opportunities for both producers and service companies to benefit but the view of the business must change in order to achieve the benefits (Kujala *et al.*, 2011). The change in focus from *what to offer* to *what value the offer brings for the customer* is required, and to adopt a *holistic approach* on the value creation process (Kowalkowski *et al.*, 2013; Famurewa *et al.*).

Some scholars emphasize that business model plays a significant role within organizations because it helps to create and capture value through activities (Zott *et al.*, 2011). Going forward, business model tends to create value in cooperation with partners meaning a value network that includes suppliers, partners, distribution channels, and coalitions that extend the company's resources (Hamel, 2000; Zott *et al.*, 2011). The digital technologies such as IoT and BDA provide an excellent opportunity to create and manage the value network collecting information and uniting the stakeholders.

Other scholars pay attention to business model in the domains of innovation and technology management (Chesbrough, 2007a, 2007b, 2010; Chesbrough & Rosenbloom, 2002; Johnson & Suskewicz, 2009). From this point of view, business model seems as a tool to connect customers' needs and firm technology through the process of exploiting the value potential of new technologies and transforming it into market outcomes. Still others scholars concentrate on the relationship between mode of innovation, and 'open innovation' in particular, and business models. In this regard, business model is seemed as subject of innovation (well-known as the open business model or business model innovation) with collaborative relations between the company, the market, and communities in the core (Chesbrough, 2007a, 2007b, 2010; Mitchell & Coles, 2003; Zott *et al.*, 2011). With

development of digital technologies (such as robotics and additive manufacturing) the process of industry innovation will be faster and will require new knowledge and skills.

Faced with the commoditization of goods, declining profitability and customers with complex needs, an increasing number of manufacturing companies are reorienting their value propositions from selling goods to providing solutions (Windahl & Lakemond, 2010), in order to gain competitive advantage, increase revenues and margins, achieve higher customer satisfaction and retention (Oliva & Kallenberg, 2003; Neely, 2008). In fact, this transition involves fundamental changes in the way of creating and delivering value and dealing with customers and stakeholders (Martinez *et al.*, 2010; Turunen & Finne, 2014). Thus, manufacturers, to be successful in this change, should not only move their value proposition, but need to redesign their business model from a product-centric one to a product-service system (PSS model) (Kindström, 2010, 2014; Windahl & Lakemond, 2010). Adrodegari *et al.* (2017) summarizes approaches for PSS models (see Table 1).

Table 1: A product-service system models

Author	Year	Name
V an Halen et al.	2005	MePSS
Maxwellet al	2006	Sustainable Product and/or Service Development (SPSD) _[SEP]
Copani et al.	2008	Pattern to design new business models
Muller and Stark	2008	PSS requirements generation method
Pawar et al.	2009	PSO framework _[SEP]
Shih et al.	2009	PSS design and evaluation - PSSDAE
Ho et al.	2011	Management consulting framework for designing and implementing service business model innovation _[SEP]
Lee et al.	2011	Business Model Design Procedure
Martinez and Turner	2011	Strategic value creation roadmap
V an Ostaeyen et al.	2011	Generic PSS Design Method _[SEP]
Ehrenhöfer& Kreuzer	2012	Business model design toolbox
Barquet et al.	2013	Framework to support PSS adoption
Dimache and Roche	2013	TraPSS methodology _[SEP]
Wiesner et al.	2014	Methodology for BM Development

Source: Adrodegari *et al.* (2017)

PSSs enable to gather more information about products, their life cycles, customers, partners, suppliers, and so on, analyze it and provide a complex solutions. Thus, PSS become a logic continuation of Industry's 4.0 development.

The efficiency-centred business model design (EBMD) and the novelty-centred business model design (NBMD) are other two approaches of business model design based on the theory of constraints. The efficiency-centred business model design (EBMD) is based on constructing greater efficiency through rebuilding the business model elements, such as by increasing transaction speed or reducing transaction costs (Zott & Amit, 2008, 2010). The novelty-centred business model design (NBMD) based on creating and capturing new opportunities through redesigning governance, content or structure. NBMD often implements novel activities by bringing new parties into the system (content), restructuring transaction participants and activities (structure) or adopting new ways to govern transactions (governance) (Zott & Amit, 2008, 2010). EBMD focuses on the alignment of all elements and the robustness of the system. The main sources of value creation in EBMD are lower costs, faster delivery and better service or production. (Abernathy & Clark, 1985; Jansen *et al.*, 2006). Thus, for EBMD, firms need to align their internal resources to increase the robustness. NBMD, in contrast, focuses on the creation or capture of new opportunities. For NBMD, firms often need to restructure elements of the activity system such as content, structure and governance centred on the new value proposition (Casadesus-Masanell & Zhu, 2013), which often requires restructuring their resources. It's remarkable that digital technologies such as BDA and IoT are a source of both EBMD and NBMD.

4. Conclusion and discussion

The extensive development of digital technologies had led to occurrence of new term – Industry 4.0 that is considered as new Industrial Revolution. The new technologies such as IoT, BDA, robotics, additive manufacturing, etc. are widely disseminated and used in different fields (retail, pharmacy, logistic and etc.). At the same, these technologies change approaches to doing business providing new opportunities.

The new business models that use the achievements of Industry 4.0 are aggregate directions for future development and should be detailed and refined according to the organization's features.

The current paper has limitations related to the exciting models in the reviewed literature. Authors are planning to overcome limitations by extending the secondary data. The next step will be also to analyze some companies that use different approaches of business modeling in terms of Industry 4.0.

References

- Abernathy, W.J., Clark, K. (1985). Mapping the winds of creative destruction, *Research Policy*, Vol. 14, Issue 1, 3–22.
- Adrodegari, F., Pashou, T., and Saccani, N. (2017). Business Model Innovation: process and tools for service transformation of industrial firms, *Procedia CIRP*, № 64, 103 – 108.
- Casadesus-Masanell, R., & Zhu, F. (2013). Business model design and competitive imitation: the case of sponsor-based business models, *Strategic Management Journal*, Vol. 34, Issue 4, 464–482.

- Chesbrough, H.W. (2007a). Business model innovation: it's not just about technology anymore, *Strategy and Leadership*, Vol. 35, № 6, 12–17.
- Chesbrough, H.W. (2007b). Why companies should have open business models, *MIT Sloan Management Review*, Vol. 48, Issue 2, 22–28.
- Chesbrough, H. (2010). Business model innovation: opportunities and barriers, *Long Range Planning*, Vol. 43, Issue 2, 354–363.
- Chesbrough, H.W., Rosenbloom, R.S. (2002). The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spinoff companies, *Industrial and Corporate Change*, Vol. 11, 533–534.
- Constantiou, I. & Kallinikos, J. (2015). New games, new rules: big data and the changing context of strategy, *Journal of Information Technology*, Vol. 30 No. 1, 44-57.
- Davenport, T.H., Barth, P. & Bean, R. (2012). How big data is different, *MIT Sloan Management Review*, Vol. 54 No. 1, 43-46.
- Dijkman, R.M., Sprenkels, B., Peeters, &T., Janssen, A. (2015). Business models for the Internet of things, *International Journal of Information Management*, Vol. 35, Issue 6, 672–678.
- Espada, J.P., Martínez, O.S., Lovelle, J.M.C., G-Bustelo, B.C.P., Álvarez, M.Á., & García, A.G., (2011). Modeling architecture for collaborative virtual objects based on services, *Journal of Network and Computer Applications*, Vol. 34, Issue 5, 1634-1647.
- Famurewa, S.M., Asplund, M., Galar, D., & Kumar, U. (2013). Implementation of performance based maintenance contracting in railway industries, *International Journal of System Assurance Engineering and Management*, Vol. 4, Issue 3, 231-240.
- Hamel, G. (2000), *Leading the Revolution*. Harvard Business School Press, Boston.
- Henke, N., Bughin, J., Chui, M., Manyika, J., Saleh, T., Wiseman, B. & Sethupathy, G. (2016). *The Age of Analytics: Competing in a Data-Driven World*, McKinsey Global Institute.
- Jazdi, N. (2014). Cyber Physical Systems in the Context of Industry 4.0, *IEEE International Conference on Automation, Quality and Testing, Robotics*, 1–4.
- Jansen, J.J.P., Van den Bosch, F.A.J., & Volberda, H.W. (2006). Exploratory innovation, exploitative innovation, and performance: effects of organizational antecedents and environmental moderators, *Management Science*, Vol. 52, Issue 11, 1661–1674.
- Johnson, M.W., & Suskewicz, J. (2009). How to jump-start the clean economy, *Harvard Business Review*, Vol. 87.
- Kagermann, H., Wahlster, W. & Helbig, J. (2013). *Recommendations for Implementing the Strategic Initiative INDUSTRIE 4.0*, München.
- Kans, M. & Ingwald, A. (2016). Business Model development towards Service Management 4.0", *Procedia CIRP*, Vol. 47, 489 – 494.
- Kiel, D., Arnold, C., Collisi, M., Voigt, K.I., (2016). The impact of the industrial Internet of things on established business models, *Proceedings of the 25th International Association for Management of Technology (IAMOT) Conference*, 673-695.
- Kindström, D. (2010). Towards a service-based business model - Key aspects for future competitive advantage, *European Management Journal*, Vol. 28, Issue 6, 479-490.
- Kindström, D., Kowalkowski, C. (2014). Service innovation in product-centric firms: A multidimensional business model perspective, *Journal of Business and Industrial Marketing*, Vol. 29, Issue 2, 96-111.
- Kowalkowski, C., Witell, L., & Gustafsson, A. (2013). Any way goes: Identifying value constellations for service infusion in SMEs, *Industrial Marketing Management*, Vol. 42, Issue 1, 18-30.

- Kujala, S., Kujala, J., Turkulainen, V., Artto, K., Aaltonen, P., & Wikström, K. (2011). Factors influencing the choice of solution-specific business models, *International Journal of Project Management*, Vol. 29, Issue 8, 960-970.
- Magruk, A. (2016). Uncertainty in the Sphere of the Industry 4.0 – Potential Areas to Research, *Business, Management and Education*, Vol. 14, № 2, 275–291.
- Martinez, V., Bastl, M., Kingston, J., & Evans, E. (2010). Challenges in transforming manufacturing organisations into product-service providers, *Journal of Manufacturing Technology Management*, Vol. 21, Issue 4, 449– 469.
- McAfee, A. & Brynjolfsson, E. (2012). Big data: the management revolution, *Harvard Business Review*, Vol. 90 No. 10, 61-67.
- McFarlane, D., Sarma, S., Chirn, J.L., Wong, C.Y., & Ashton, K. (2003). Auto ID systems and intelligent manufacturing control, *Engineering Applications of Artificial Intelligence*, [Volume 16, Issue 4](#), 365-376.
- Mitchell, D., & Coles, C. (2003). The ultimate competitive advantage of continuing business model innovation, *Journal of Business Strategy*, Vol. 24 (5), 15–21.
- Neely, A. (2008). Exploring the financial consequences of the servitization of manufacturing, *Operations Management Research*, Vol. 1, Issue 2, 103-118.
- Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services, *International journal of service industry management*, Vol. 14, Issue 2, 160-172.
- Oriwoh, E., Sant, P., Epiphaniou, G. (2013). Guidelines for Internet of things deployment approaches – the thing commandments, *Procedia Computer Science*, Vol. 21, 122–131.
- Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. John Wiley & Sons. [[[SEP]]]
- Paulus-Rohmer, D., Schatton, H. & Bauernhansl, T. (2016). Ecosystems, strategy and business models in the age of digitization – How the manufacturing industry is going to change its logic, *Procedia CIRP*, Vol. 57, 8 – 13.
- Posada, J. et al. (2015). Visual Computing as a Key Enabling Technology for Industrie 4.0 and Industrial Internet, [IEEE Computer Graphics and Applications](#), Vol. 35 , Issue 2, 26-40.
- Pereira, A.C., & Romero, F. (2017). A review of the meanings and the implications of the Industry 4.0 concept, *Procedia Manufacturing* # 13, 1206–1214.
- Rüßmann, M., Lorenz, M., Gerbert, P., & Waldner, M. (2015). *Industry 4.0: The Future of Productivity and Growth in Manufacturing Industries*, Boston Consulting Group.
- Schuh, G., Potente, T., Potente, C.W., & Hauptvogel, A. (2013). Sustainable increase of overhead productivity due to Cyber-Physical Systems. *11th Global Conference on Sustainable Manufacturing*, 332-335. [[[SEP]]]
- Sirkin, H.L., Zinser, M. and Rose, J.M. (2015). *Why Advanced Manufacturing Will Boost Productivity*, Boston Consulting Group, Boston, MA.
- Solima, L., Della Peruta, M.R., & Del Giudice, M., (2016). Object-generated content and knowledge sharing: the forthcoming impact of the Internet of things, *Journal of the Knowledge Economy*, Vol. 7, Issue 3, 738–752.
- Strange, R. & Zucchella, A. (2017). Industry 4.0, global value chains and international business, *Multinational Business Review*, Vol. 25, No. 2, 174-184.
- Turunen, T., & Finne, M. (2014). The organisational environment’s impact on the servitization of manufacturers, *European Management Journal*, Vol. 32, Issue 4, 603-615.
- Uckelmann, D., Harrison, M., and Michahelles, F., (2011). *Architecting the Internet of things*. Springer Science & Business Media, Berlin.
- Wan, J., Tang, S., Li, D., Wang, S., Liu, C., Abbas, H., et al. (2017). A manufacturing big data solution for active preventive maintenance, [IEEE Transactions on Industrial Informatics](#), 13(4), 2039–2047.

Wang, S.Y., Wan, J., Li, D., & Zhang, C. (2016). Implementing smart factory of Industry 4.0: An outlook, *International Journal of Distributed Sensor Network*, 4, 1-10.

Weyer, S., Schmitt, M., Ohmer, M. & Gorecky, D. (2015). Towards Industry 4.0 – Standardization as the crucial challenge for highly modular, multi-vendor production systems, *IFAC-PapersOnLine*, 48 (3), 579–584. ^[1]_{SEP}

Windahl, C., & Lakemond, N. (2010). Integrated solutions from a service-centered perspective: applicability and limitations in the capital goods industry, *Industrial Marketing Management*, Vol. 39(8), 1278-1290.

Wnuk, K., Murari, B.T. (2016). The impact of Internet of things on software business models, *International Conference of Software Business*, 94–108.

Zezulka, F., Marcon, P., Vesely, I., & Sajdl. O. (2016). An Introduction in the phenomenon, *IFAC-PapersOnLine*, Vol. 49, Issue 25, 8–12. ^[1]_{SEP}

Zhong, R.Y., Xu, X., Klotz, E., and Newman, S.T. (2017). Intelligent Manufacturing in the Context of Industry 4.0: Review. *Engineering*, 3, 616–630.

Zott, C., Amit, R. (2008). The fit between product market strategy and business model: implications for firm performance, *Strategic Management Journal*, Vol. 29, Issue 1, 1–26. ^[1]_{SEP}

Zott, C., Amit, R. (2010). Business model design: an activity system perspective, *Long Range Planning*, Vol. 43, 216–226. ^[1]_{SEP}

Zott, C., Amit, R., & Massa, L. (2011). The business model: recent developments and future research, *Journal of Management*, Vol. 37, Issue 4, 1019–1042.

Winning Business Models for the 4th Industrial Revolution

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Abstract: The objective of this paper is to analyze the impact of the Industry 4.0 on business models considering technological change as a driver of strategic innovation. The research aims to provide the key to interpreting a process of innovation that, starting from the technological transformation, translates it into a broader change of business models. A structured literature review has been developed analyzing 144 sources divided into scientific papers, reports from consultancy firms and institutional reports, to identify the importance given by the literature to the technologies and their impact on the single building blocks of the business model. The research has led to the identification of four types of business models, which represent a framework to understand the crucial issues to be applied to interpret the phenomenon strategically. The technologies of the Industry 4.0 allow the development of new business models. In this way, it is possible to start a strategic innovation and create new markets through a unique value proposition. The analysis led to understand the potential of Industry 4.0 as the strategic innovation of business models and its impact on knowledge management processes.

Keywords: Business model; Industry 4.0; innovation; strategy; structured literature review

1. Introduction

The concepts of "innovation" and "Strategy" have become the fundamental themes of two rich areas of study in the nineties (Schlegelmilch *et al.*, 2003). The literature focused on strategy, defines the way to compete within a specific market sector and outlines the field of action of the organization through the choices needed to achieve a long-term or overall aim. On the other hand, the literature on innovation has focused its attention on the level of product and process innovation (Schlegelmilch *et al.*, 2003). Therefore, while the literature on strategy focuses on the overall aims of the organization, the concept of innovation, until the mid-nineties, was never used at the enterprise level.

The different focus of innovation and strategy are interesting especially considering the intrinsic nature of the term innovation. Indeed, innovation represents the ability to think and to practice new or better ways of doing things and thus represents an exceptional mechanism, capable of unleashing the creative spirit. Innovation can be the trigger for opening the mind to possibilities that were previously unknown, leading to progress in areas essential for human development. Therefore, innovation poses very demanding challenges but also extraordinary opportunities for companies pushing traditional approaches focused on product and process under a great pressure to expand their horizons (Porter, 1996).

Because of the need to create a more comprehensive approach on innovation, from the nineties, the concepts of innovation and strategy have started to become more linked, thanks to the introduction of the concept of strategic innovation (Schlegelmilch *et al.*, 2003). Strategic innovation consists in the development of a new concept (and therefore a model) of business, namely: new products or services, presented or combined in a new way, to create a radically new experience for clients, involving them also at an emotional level. Strategic innovation can also arise from the reconfiguration of the sector's value chain to change the rules of the game - exploiting, for example, the possibilities offered by new technologies to reach the final customer directly to enhance the distinctive competencies of the company (Buaron, 1981).

From that point on literature agreed that strategic innovation goes beyond the simple adjustment of the current business strategy. Indeed, strategic innovation requires extensive changes both at the level of the structure and at the level of business processes. Therefore, it becomes necessary especially for companies anchored to "traditional" business models (BM) that are resistant to strategic change (Spender, 1989).

1.1 Strategy innovation and the BM canvas

BMs represent the underlying logic of how the company is doing business, creates value for stakeholders and captures a share of value for itself (Biloslavo *et al.*, 2018). The business model "Canvas" is a strategic tool that uses visual language to create and develop innovative BM. It represents the way in which a company creates, distributes and captures value. The value offered is the reason why customers choose a company rather than another by solving a customer problem or meeting their needs. Each value consists of a selected set of products or services that meets the requirements of a specific customer segment. Some value propositions can be innovative and represent a new or disruptive offer, others may be similar to the ones existing on the market, but with additional characteristics and attributes.

The framework adopted in this research is the one elaborated by Biloslavo *et al.* (2018), which consists in a reworking of the well-known model of Osterwalder and Pigneur. The model starts from a triangular figure that can be "open," thus configuring a direct and straightforward visual reference scheme, suitable for a lean but complete representation of all the eight elements of the business model:

1. suppliers,
2. resources,
3. internal processes,
4. external processes,

5. products,
6. customers,
7. society,
8. value proposition.

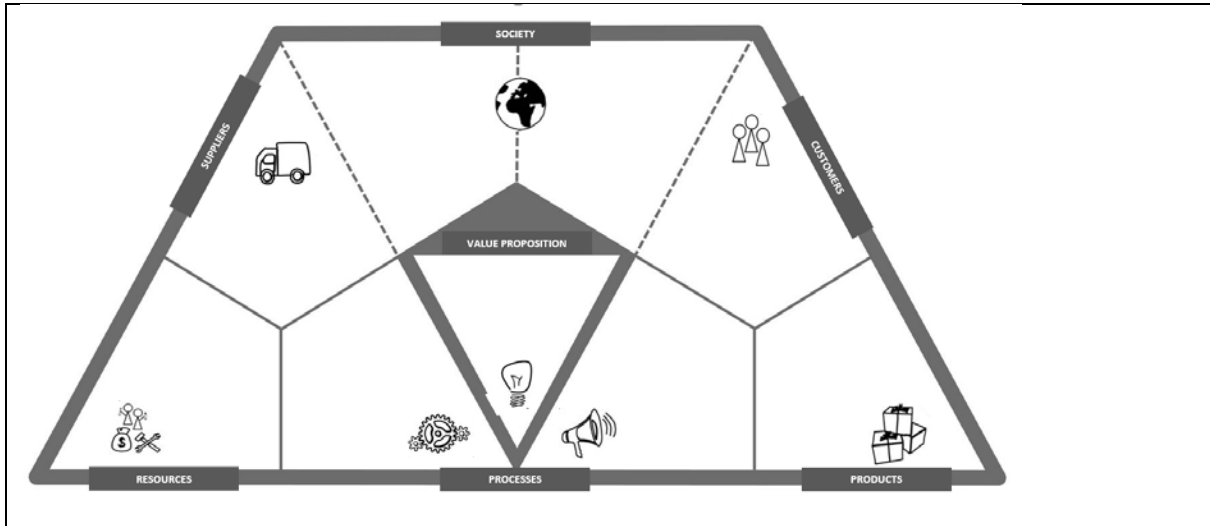


Figure 1: Our framework

1.2 Strategic innovation and Industry 4.0

The growing attention on the role BM canvas accompanies the development of the literature on innovation. Scholars distinguish three different sources of strategic innovation: Technology Push, Market Pull, and design-driven (Verganti, 2011). These three different types of innovation start from different assumptions and therefore lead to equally different results.

The technology push innovations derive from the exploration of new technological possibilities by the company. Typically, they lead to radical innovations in technical and technological terms and changes in consumer needs. According to Schumpeter, it is the company that imposes "change," and the consumer is instrumental to the fact that the activity of the producer is successful (Schumpeter, 1971). The company, therefore, moves independently, and the introduction of innovations does not take place according to the needs of consumers. In this way, the producer "educates" the consumer, to push him to let his new products to be included among his preferences. Strategic innovation, however, cannot derive only from a technology push innovation. In fact, if innovation focuses solely on the increase in technical or technological characteristics, without considering the needs of the client, it risks running out of technological effort (Verganti, 2008).

Market pull innovations, on the other hand, originate from an understanding of the needs of customers or users or requests from the market. They usually start with the analysis of the users' needs and with the following search for technologies that can satisfy them in a better way. These innovations are purely incremental because the market rarely, and more particularly the customer, can express needs that go beyond its usual consumption experience (Verganti, 2008).

Design-driven innovation is not a technological innovation, nor does it derive from the needs expressed by the market, but it is an innovation of meaning. This type of innovation arises from the exploration and understanding of existing and future trends in socio-cultural models and offers new visions, new concepts and radically new senses to existing products or services and therefore acts on potential needs or emotional and symbolic aspects. They are, therefore, innovations pushed by the vision of the company regarding the possible changes in meanings and languages that could emerge in the future (Verganti, 2008) and not from current customer needs.

Design-driven innovations can be both radical and incremental. In fact, they can bring about a change in language, which in turn determines the message transmitted to the client and therefore the meaning of the products or services offered, only partially or different from that existing in the current socio-cultural models. According to Biloslavo *et al.* (2018), design-driven innovations are the only way for companies already present in the market to renew their position of success. At the same time, it represents a way for new entrants to overcome the significant disadvantages compared to companies already present in the market.

Interestingly, the development of the innovation called “Industry 4.0” is providing new sources of innovations that draw on all these characteristics, providing new challenges for changing companies’ BM. Indeed, Industry 4.0 leads to a digital transformation, which takes the form of interconnected systems able to interact with each other and to collect and analyze data to adapt to changes. It disrupts the value chain, and for this reason, companies must not limit themselves to a technological analysis of transformation but are forced to rethink their BM, their way of working to create value for their customers.

1.3 Research aims and paper structure

Moving from the above-presented premise, this study employs a structured literature review (SLR) approach (Massaro, Dumay, *et al.*, 2016) to understand how Industry 4.0 is changing companies’ BM providing new opportunities and challenges. The rest of the paper is structured as follows. Section 2 presents the research methodology. Section 3 depicts main findings. Section 4 provides conclusions and future research opportunities.

2. Research method

This paper employs an SLR (Massaro, Dumay, *et al.*, 2016). Conducting an SLR “can help experienced scholars develop new and interesting research paths by accessing and analyzing a considerable volume of scholarly work” (Massaro, Dumay, *et al.*, 2016). Additionally, Massaro *et al.* (2016) state that an SLR can “contribute to developing research paths and questions by providing a foundation” for future investigation. Interestingly, SLRs seem to provide an alternative to more ‘traditional’ literature reviews, to reach more “defensible” and “replicable” results. This approach has already been used to investigate interdisciplinary fields of accounting, auditing and accountability (Guthrie and Parker, 2011), Knowledge Management in the Public Sector (Massaro *et al.*, 2015), Knowledge Management in Small and Medium Enterprises (Massaro, Handley, *et al.*, 2016), organizational knowledge

protection (Manhart and Thalmann, 2015), human capital accounting (Guthrie *et al.*, 2012; Guthrie and Murthy, 2009), the use of content analysis (Dumay and Cai, 2014), Integrated Reporting (Bernardi *et al.*, 2014; Dumay *et al.*, 2016) and Intellectual Capital (IC) (Dumay, 2014). Figure 1 depicts the model described by Massaro *et al.* (2013).

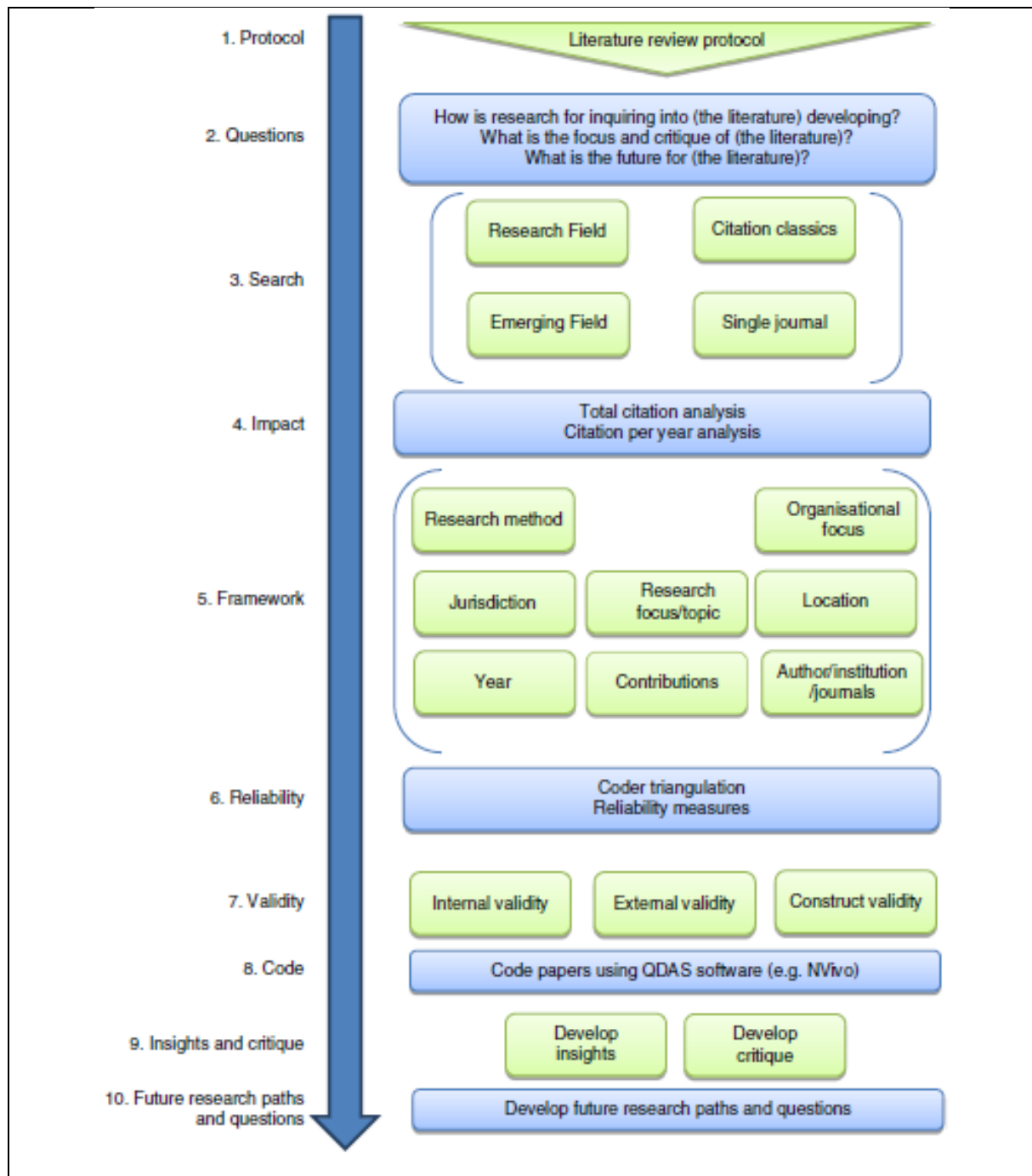


Figure 2 SLR Methodology

Following Massaro *et al.* (2016) approach, first, we developed a Research Protocol describing the steps shaping an SLR. A total number of 140 documents divided into journal articles, consulting reports, institutional reports and other sources have been searched using keyword searches in databases such as Scopus, Ebsco, Google Scholar and professional or institutional

websites focused on the topic of Industry 4.0 (e.g. a specific section of the economic ministry of Italy). More than 18,770 references have been coded in 162 nodes using an open coding approach (Miles *et al.*, 2013). The inquiry was developed around two main research questions:

RQ1. *How does Industry 4.0 affect existing BM?*

RQ2. *How could Industry 4.0 lead to the development of new BMs?*

Considering that we employed an open coding approach, they could not apply validity measures such as the Krippendorff's alpha. To ensure validity, results were discussed by whole the research team to ensure consistency of the coding approach. Additionally, word searches were employed to ensure that relevant nodes were not missed or underestimated. The following sections describe the findings of the research.

3. RQ1. How Industry 4.0 affects existing BM

This section depicts the results of the SLR focusing on the first research question: *how does Industry 4.0 affect existing BM?* To answer the first research question we analyzed existing definitions provided by the authors. According to (Schumacher *et al.*, 2016, p. 162) "Industry 4.0 refers to recent technological advances where the internet and supporting technologies (e.g., embedded systems) serve as a backbone to integrate physical objects, human actors, intelligent machines, production lines and processes across organizational boundaries to form a new kind of intelligent, networked and agile value chain." Main technologies considered within the concept of Industry 4.0 are depicted in Figure 3.

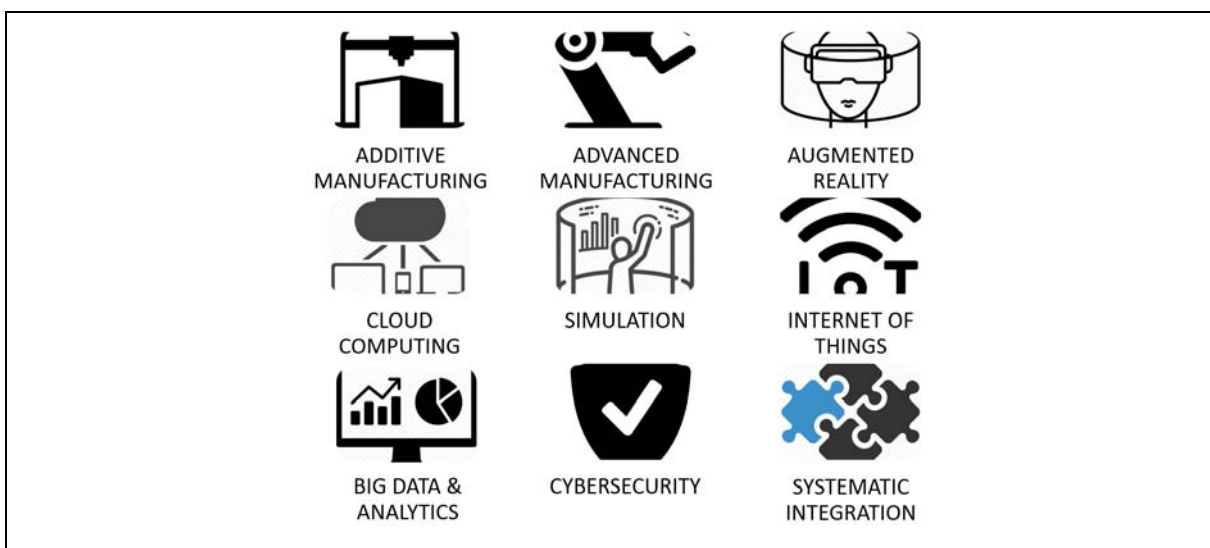


Figure 3: Industry 4.0 Technologies

To better focus the research, we analyzed how these technologies are described regarding their impact on the company's BM. Results of this analysis are depicted in the following figure.

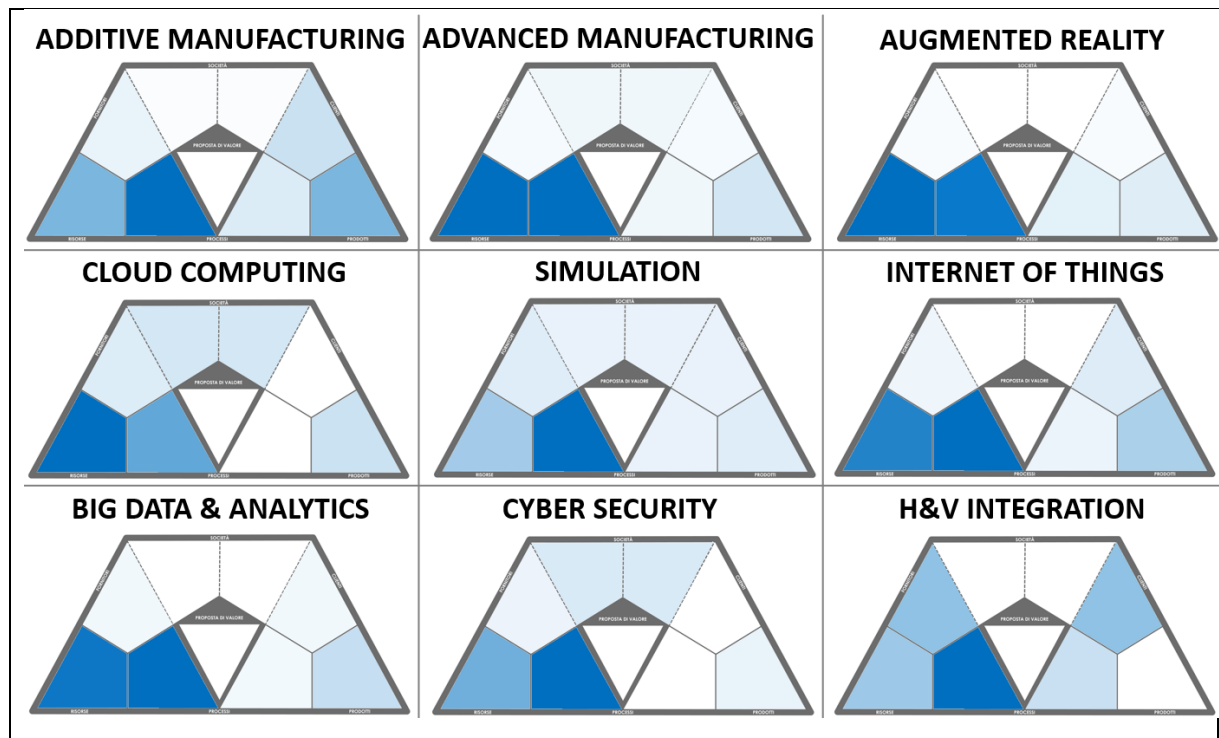


Figure 4: Industry 4.0 Technologies heatamp according to the literature

The figure shows the synthesis of the nine heatmaps referring to each enabling technology. The intensity of the color of each building block in the heatmaps is associated with the importance recognized by the literature to the change due to the development of the technology.

The literature focuses its attention on the internal part of the company and, in particular, on internal processes and resources, interpreting Industry 4.0 as a tool to improve productivity and efficiency of the methods. However, we could find a keen interest in the literature towards customers and their increasingly central and collaborative role in the value chain and also on products, which are now more innovative and full of smart functionality. There is an openness towards elements of the business model addressed to the outside, such as customers, products, external processes of the company and society. On the other hand, literature seems to neglect the impact of technologies on the value proposition, adopting a more operative perspective. The following tables (Table 1a and Table 1b) provide more details describing how each technology can affect each building block shaping the company's BM.

Table 1a: Results of the literature review on the impact of Industry 4.0 on company’s BM

Technology	Business Model Canvas Building Blocks							
	Suppliers	Resources	Internal processes	External processes	Products	Customers	Society	Value proposition
Additive manufacturing	Suppliers of 3d technologies	3D technologies	Product development	Faster delievery time	Complex products	User entrepreneurs	University	
	Reduction of components’ suppliers	Human resources Innovative & sustanaible materials	Assembling Prototyping Design	Transport reduction Digital distribution channels	Increased range of products Customization	Customers’ involvement in processes	Start ups Research institutes	
Advanced manufacturing	Supply chain optimization	Collaborative robot	Efficiency and flexibility	Autonomus veicles	Smart products		Agreement with schools, universities, and governments	
		Robot coordinator	Quality & precision Inbound logistic	Faster delievery time	Life Cycle optimization Customization			
		Human machine interaction						
Augmented reality		Smart devices HR training	Simplified assembly & maintenance Less errors Virtualization	Logistics	Customized products New after-sale services	Active role in product design		

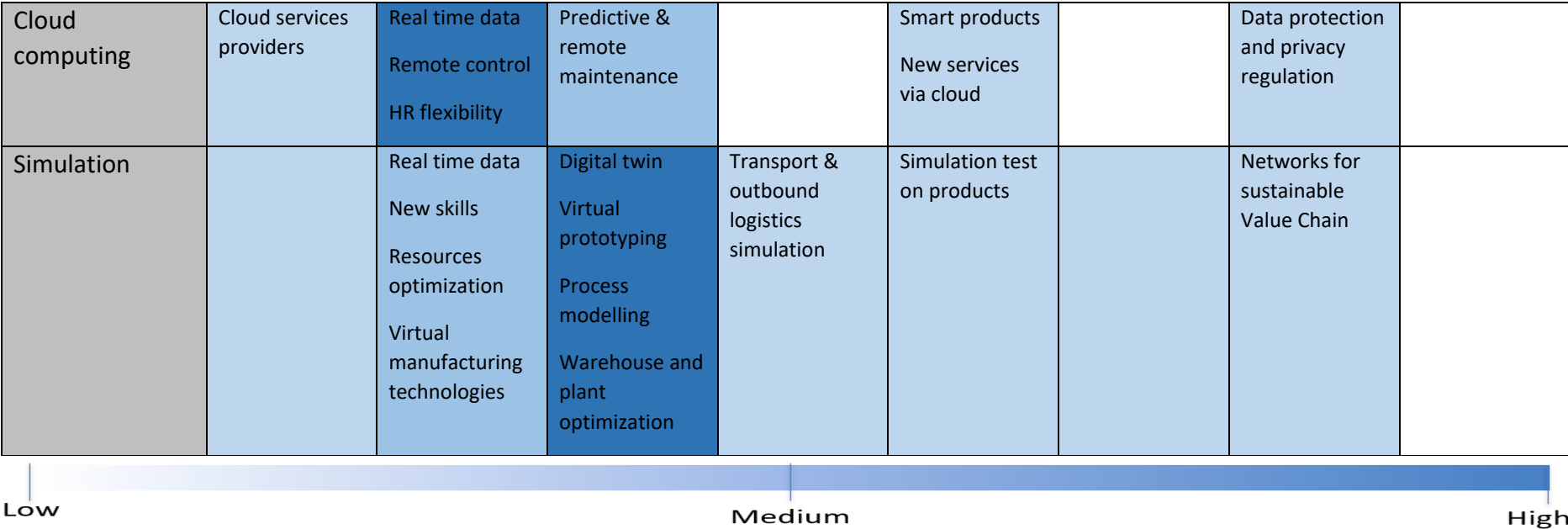
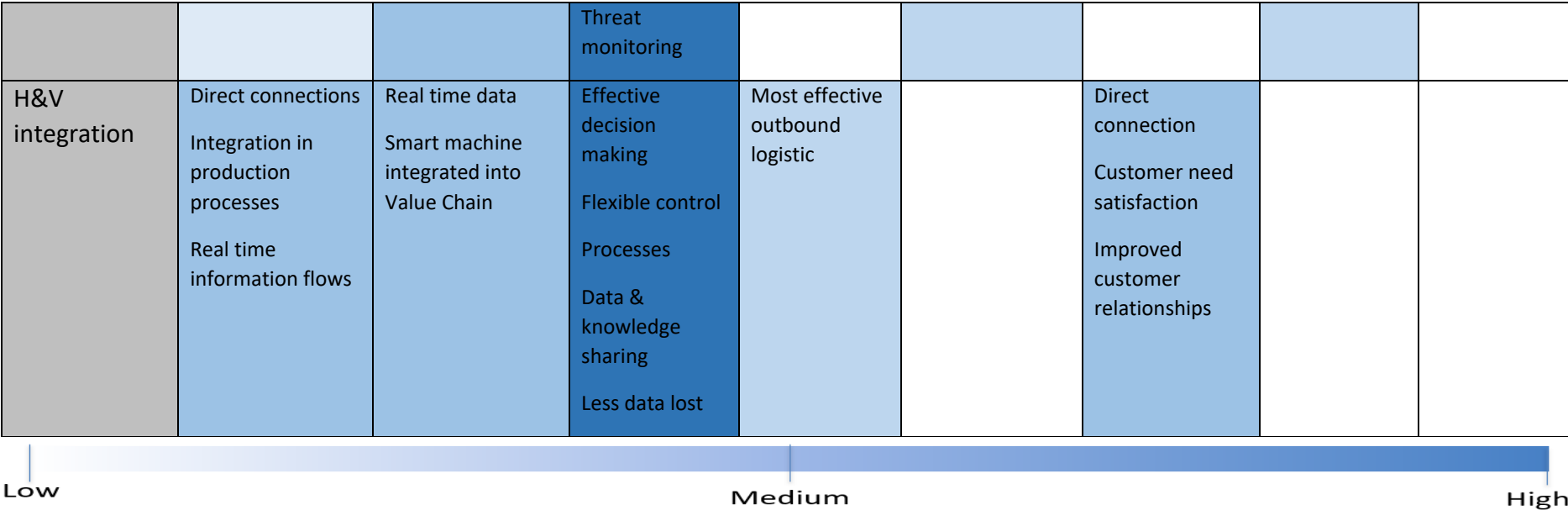


Table 1b: Results of the literature review on the impact of Industry 4.0 on company’s BM

Technology	Business Model Canvas Building Blocks							
	Suppliers	Resources	Internal processes	External processes	Products	Customers	Society	Value proposition
Internet of things		Real time data Technical staff Communicating devices Sensors & actuators	Remote control Processes virtualization Predictive maintenance Real Time adaption	Produets localization Means of transport localization	New services Smart products Customization	Customer experience	Integration of actors for cocreation processes Integration along the value chain	
		Smart machinesa						
Big data & analytics	Suppliers of hardware, communication services & system integrators	Data Collection & Analytics tools	Predictive maintenance Collection, analysis and storage of data Process monitoring	Delievery time optimization	Self control and self-diagnosis Customization	Fidelity Deep understanding of cutomers’ needs		
Ciber security	Selected suppliers	Data protection Capabilities	Risk management processes Framework provision		Protection of Data Embedded in Products		Institutions (e.g. CERT, intelligence)	



4. RQ 2. How Industry 4.0 leads to the development of new BMs

Findings of the SLR show that Industry 4.0 allows the development of new BM starting a strategic innovation that creates new market spaces through a unique value proposition. Findings allowed us to identify twelve new BM characterized by innovative value propositions, thanks to the new technological opportunities provided by the Industry 4.0. Finally, we were able to group the 12 new business models into four categories, namely: Mass customization BM, data & analytics BM, as a service BM and platform BM. Each group is described in the following subsections.

4.1 Mass customization BMs

In the category "Mass Customization" we can identify specific BMs that work on the value discipline of Operational Excellence (Treacy and Wiersema, 1993). Technology provided by the Industry 4.0 allows transforming traditional paradoxes such as "man vs. machine," "profit vs. sustainability," "craft production vs. industrial production" and "knowledge exploration vs. knowledge exploitation."

Value production plays a central role for Industry 4.0, as it involves integrating the product with all the actors in the value chain, as it acts as an interconnection tool. This connection lays the foundation for cyber-physical systems, intelligent networks of machines, ICT systems, products, and people. In this context, the production of value is automated and dematerialized and makes it possible to combine large-scale production with customization, thus moving to a more dynamic and on-demand approach, increasing at the same time efficiency and productivity.

Table 2: Mass Customization BM and the impacts of Industry 4.0 on the BM Building Blocks

Business Model Canvas Building Blocks							
Suppliers	Resources	Internal processes	External processes	Products	Customers	Society	Value proposition
Vertical integration Cloud computing Cyber security	Internet of things Cloud computing Adv Manufac Big data Aug reality	Add manufac Internet of things Cloud computing Adv Manufac Big data Aug reality Simulation Vert integr	Cloud computing Big data	Cyber security Cloud computing Internet of things Big Data	Vert integr Cyber security Cloud computing	Vert integr	
	Big data	Add manufac Internet of things Adv Manufac Big data		Add manufac Big data Adv Manufac	Big data Cloud computing Internet of things		
	Big data	Big data Cyber security		Big data			

Low Medium High

Therefore, BM is set up for the production of high-tech goods that use increasingly sophisticated materials and can adapt dynamically to changing market conditions. This adaptation is also favored by the proximity to the customers, which allows to fully understand the clients' needs by establishing a proximity relationship both in a physical and virtual sense. The products are so unique and customized, being designed directly to the requests of the final consumer. Table 2 depicts main impacts of Industry 4.0 on the BM of Mass Customization. The color in the table describes the magnitude of the effect.

4.2 Servitization BM

Services are taking an increasingly central position, allowing the creation of valuable proposals based on the combination of services and products, integrated through technologies. The digital transformation is offering the possibility of creating BMs based on the provision of services, and increasingly customer-oriented. The services allow to combine the virtual world with the physical one, and to set up new profit models such as performance-based contracts, product-as-a-service, pay-per-use, subscription-based and machine-as-a contracts -service.

The new BM of the "servitization" category try to identify the "why" behind the need to purchase and to respond to this by transforming products into services. In fact, the logic of these models lies in the fact that the value is not represented only by the product itself, but by what is made possible through its use. The service thus becomes the very foundation of the exchange and provide the base of the value discipline of product/service leadership (Treacy and Wiersema, 1993). The following table depicts main impacts of Industry 4.0 on the BM of Servitization. The color in the table describes the magnitude of the effect.

Table 3: Servitization BM and the impacts of Industry 4.0 on the BM Building Blocks

Business Model Canvas Building Blocks							
Suppliers	Resources	Internal processes	External processes	Products	Customers	Society	Value proposition
	Cloud computing Big data	Cloud computing Big data Internet of things		Cloud computing Internet of things	Big data Internet of things		
	Big data	Big data Internet of things		Cloud computing Big data Internet of things	Vertical integration		
	Big data	Big data Internet of things		Cloud computing Big data Internet of things	Vertical integration		

4.3 Data-driven BM

The exploitation of the value generated by the data obtained and the recognition of the centrality of the client lead to the development of new BM based on big data & analytics technologies. The data represent the core driver of innovation and competition, as they are necessary to achieve leadership positions in the creation of value.

These BM allow the development of innovative methods for the collection and use of data, and to benefit from the value embedded in information. The data make it possible to increase product functionality but can also be exploited as a product to obtain incremental revenues. The information collected is used by companies for production and commercial purposes, and this requires attention to the legal profiles of their use in the private sphere, but also about the price policies. Therefore, Data-driven BM allow the development of a new perspective on the customer intimacy value discipline is reducing barriers to reach customers and customize products (Treacy and Wiersema, 1993). The following table depicts main impacts of Industry 4.0 on the Data-driven BM. The color in the table describes the magnitude of the effect.

Table 4: Data-driven BM and the impacts of Industry 4.0 on the BM Building Blocks

Business Model Canvas Building Blocks							
Suppliers	Resources	Internal processes	External processes	Products	Customers	Society	Value proposition
Vertical integration Big data Internet of things	Internet of things Big data	Cloud computing Big data Internet of things	Big data	Internet of things Big data	Internet of things Big data Vertical integration		
Big data Internet of things	Big data	Cloud computing Big data		Big data	Big data Internet of things		
	Big data Internet of things			Internet of things Big data Cloud computing	Big data Internet of things		

4.4 Platform BM

The distribution of value is undergoing significant changes thanks to technologies that reduce the distance between the company and the customer through a deeper understanding of the latter's needs.

The proximity to the customer is a crucial feature of the distribution BM. It requires the development of platforms, which support the interoperability between various actors of the value chain, based on the shared representation and updated in real time, configured on the specific needs of the user. These platforms make it possible to co-create value among networks, to share experiences and meanings, because they facilitate the exchange of data

and services among the actors of the ecosystem. The following table depicts main impacts of Industry 4.0 on the Data-driven BM. The color in the table describes the magnitude of the effect.

Table 5: Platform BM and the impacts of Industry 4.0 on the BM Building Blocks

Business Model Canvas Building Blocks							
Suppliers	Resources	Internal processes	External processes	Products	Customers	Society	Value proposition
Additive manufactur. Vertical integration	Additive manu- facturing Cloud computing	Additive manu- facturing Internet of things	Additive manu- facturing Internet of things Augmented reality	Additive manu- facturing	Additive manu- facturing		
	Big data		Internet of things	Big data Internet of things	Big data Internet of things		
Big data Internet of things	Big data Internet of things	Big data Internet of things Cloud computing	Big data Internet of things Cloud computing		Big data Internet of things		

5. Conclusions and future Knowledge Management challenges

Our research develops an SLR to answer two main research questions related to the definition of Industry 4.0 and its role to promote the development of new BM. Results show that Industry 4.0 is a complex topic shaped mainly from nine different technologies. Each technology has specific impacts on company’s BM. Interestingly, while most of the impacts of Industry 4.0 focus on the production building blocks of the BM, there are significant and interesting effects also on other dimensions such as customers, external processes, and society.

Additionally, our findings show that when more technologies are combined they allow the development of new BM. New ways of developing relationships with customers, suppliers and other stakeholders are pushing new approaches to deal with the relational capital and the knowledge management processes. Additionally, new knowledge-based products can be developed thanks to the Industry 4.0, and new approaches can be defined to deal with the whole society more sustainably.

Results depict four main typologies of BM named: Mass customization BM, Servitization BM, Data-driven BM, Platform BM and show how each BM uses innovations provided by the Industry 4.0 to review traditional building blocks. Further researches could start from the results of these literature review providing concrete cases of companies that used the opportunities provided by the Industry 4.0 to develop new BM.

References

- Bernardi, C., Dumay, J., Guthrie, J. and Demartini, P. (2014), *Integrated Reporting: A literature review of an emerging research field*, TBA.
- Biloslavo, R., Bagnoli, C. and Edgar, D. (2018), "An eco-critical perspective on business models: The value triangle as an approach to closing the sustainability gap", *Journal of Cleaner Production*, Elsevier Ltd, Vol. 174, pp. 746–762.
- Buaron, R. (1981), "New-game strategies", *The McKinsey Quarterly*, Vol. Spring No. 1, pp. 24–41.
- Dumay, J. (2014), "15 years of the Journal of Intellectual Capital and counting: A manifesto for transformational IC research", *Journal of Intellectual Capital*, Vol. 15 No. 1, pp. 2–37.
- Dumay, J., Bernardi, C., Guthrie, J. and Demartini, P. (2016), "Integrated reporting: A structured literature review", *Accounting Forum*, Vol. 40 No. 3, pp. 166–185.
- Dumay, J. and Cai, L. (2014), "A review and critique of content analysis as a methodology for inquiring into IC disclosure", *Journal of Intellectual Capital*, Vol. 15 No. 2, pp. 264–290.
- Guthrie, J. and Murthy, V. (2009), "Past, present and possible future developments in human capital accounting", *Journal of Human Resource Costing & Accounting*, Vol. 13 No. 2, pp. 125–142.
- Guthrie, J. and Parker, L.D. (2011), "Reflections and projections 25 years of interdisciplinary perspectives on accounting, auditing and accountability research", *Accounting, Auditing & Accountability Journal*, Vol. 25 No. 1, pp. 6–26.
- Guthrie, J., Ricceri, F. and Dumay, J. (2012), "Reflections and projecitons: A decade of Intellectual Capital Accounting Research", *British Accounting Review*, Vol. 44, pp. 68–82.
- Manhart, M. and Thalmann, S. (2015), "Protecting organizational knowledge: a structured literature review", *Journal of knowledge management*, Vol. 19 No. 2, pp. 190–211.
- Massaro, M., Dumay, J. and Garlatti, A. (2015), "Public sector knowledge management: A structured literature review", *Journal of Knowledge Management*, Vol. 19 No. 3, pp. 530–558.
- Massaro, M., Dumay, J.C. and Guthrie, J. (2016), "On the shoulders of giants: Undertaking a structured literature review in accounting", *Accounting, Auditing and Accountability Journal*, Vol. 29 No. 5, pp. 767–901.
- Massaro, M., Handley, K., Bagnoli, C. and Dumay, J. (2016), "Knowledge Management in Small and Medium Enterprises. A structured literature review", *Journal of Knowledge Management*, Vol. 20 No. 2.
- Miles, M.B., Huberman, A. M. and Saldana, J. (2013), *Qualitative Data Analysis: A Methods Sourcebook*, Sage Publications, Thousand Oaks, CA, 3rd Ed.
- Porter, M.E. (1996), "What is Strategy ?", *Harvard Business Review*, Vol. 74 No. 6, pp. 61–78.
- Schlegelmilch, B.B., Diamantopoulos, A. and Kreuz, P. (2003), "Strategic innovation: the construct, its drivers and its strategic outcomes", *Journal of Strategic Marketing*, Vol. 11 No. 2, pp. 117–132.
- Schumacher, A., Erol, S. and Sihh, W. (2016), "A Maturity Model for Assessing Industry 4.0 Readiness and Maturity of Manufacturing Enterprises", *Procedia CIRP*, Vol. 52, pp. 161–166.
- Schumpeter, J. (1971), *Teoria dello sviluppo economico*, Sansoni Editore, Firenze.
- Spender, J.C. (1989), *Industry Recipes: The Nature and Sources of Managerial Judgement*, Blackwell.
- Treacy, M. and Wiersema, F. (1993), "Customer Intimacy and Other Value Disciplines Customer Intimacy and Other Value Disciplines", *Harvard Business Review*, Vol. 71 No. 9301, pp. 84–93.

Verganti, R. (2008), "Design, meanings and radical innovation: A meta-model and a research agenda", *Journal of Product Innovation Management*, Vol. 25 No. 5, pp. 436–456.

Verganti, R. (2011), "Innovazione di prodotto e sviluppo delle imprese".

Competitiveness, Globalization and the Organizations

Francisco Cesário

Competitiveness is a pervasive construct in Business Management research. The core of the definition is about the capability of the firm to compete successfully. Being as vague as it seems, we can say that we know what it is not but we unknown what it is. Or we can say that we know what it is ex-post when we see the firm's bottom line at the end of the year. Papers in this stream aim to open new research avenues in the field of strategy and competitiveness, with a particular focus on SMEs and the intangibles sources of competitive advantage. The issue of competitiveness is central; social dimension and interactions among parties in cooperation agreements, the manager's cognition in shaping the firm's strategic choices are treated.

Are the most innovative SMEs the most competitive ones?

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Abstract: The purpose of the present paper is to study European innovative SMEs and investigate if the most innovative SMEs are the most competitive one, based on based on the apparent productivity of labour as a proxy for competitiveness. The present paper will be based on systematic literature review approach, sustained by a literature review about the topics under study, followed by an application through a correlation analysis and a regression analysis between innovative SMEs and competitiveness variables. The analysis of the obtained results allow to conclude and answer to our initial question. The paper will be based on the theoretical framework of Economics of SMEs, which will be presented and described. According to this approach the SMEs are the locomotive of the economic growth and progress of European Union and supported by the Europe strategy 2020. The theoretical framework will be properly described to support the relations between the SMEs, innovation and competitiveness. According to existing literature, is expected to obtain a significant relation between innovative SMEs and their competitiveness. The present paper is original and allows to contribute to the scientific knowledge of the concepts under study and to the contribution of knowledge about the relevance and significant relation between innovation's SME and competitiveness.

Keywords: SME, innovation, competitiveness, internationalisation, productivity, employment, Europe

1 Introduction

The micro, small and medium-sized enterprises (SMEs) are considered the locomotive of European economy. The SMEs represent around 99% in most of the European economies and they are essential to create new jobs, to entrepreneurship and innovation, and in European Union (EU) they have a key role for fostering employment and competitiveness (Ferraz & Pereira, 2018; Pereira, 2007).

The strategic importance of SMEs in EU is based in a set of issues, that according of data of the European Commission¹, in EU, SMEs are around 23 million that provide about 75 million jobs (representing two out of every three private jobs) being responsible for the majority of new jobs created (around 85%); they represent around 99,7% of all EU companies; contribute

¹ http://ec.europa.eu/smart-regulation/guidelines/tool_19_en.htm

around of 50% of EU exports, contribute to more than half of total added value created by businesses (Ferraz & Pereira, 2018). SMEs are the backbone of European economy, once they have a great contribution for economic growth and prosperity, in great part based in their capacity of entrepreneurship, innovation and flexibility in a changing business environment that makes this kind of companies crucial for Europe's competitiveness in a global competitive environment.

As suggested by the strategy launched by the European Council in Lisbon, in March 2000, and currently supported by the Europe strategy 2020: *“reaching the objective of becoming the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth, more and better jobs and greater social cohesion will ultimately depend on how successful enterprises, especially small and medium sized ones, are”* (Observatory of European SMEs, 2002:5).

The current EU strategy for 2020 is based on a knowledge-based economy, where success will ensure a competitive and dynamic economy sustained in more and better jobs and in a higher level of social cohesion. In this framework, SMEs perform an important role for the sustainable future prosperity of the EU. As mentioned in the Small Business Act for Europe, in a global changing environment, characterized by continuous structural changes and enhanced competitive pressures, the role of SMEs has become even more important as providers of employment opportunities and as key players for the development and wellbeing of local and regional communities.

The advantages of the SMEs are based on their own capacities: small scale, flexibility, speed of adaptation to the market need, and the growing potential of entrepreneurship, innovation and international expansion (Acs & Audrestch, 1990; Pereira, 2007). However, once these smaller businesses have many economic advantages they possess also some organizational and market difficulties in trading. Taking in account the SMEs specific market disadvantages, the support for SMEs is a priority of the European Commission for economic growth, job creation and economic and social cohesion. With the purpose to increase the competitiveness of EU through SMEs, the objectives of the support policies and incentives to SMEs are: to facilitate entrepreneurship and innovation, investment and growth; avoid distortions in the Single Market and define clear rules that will be of easily applicable.

Considering the importance of SMEs in the current context of an EU based on a knowledge-based economy, characterised by a global continuous competitive and dynamic economy changing environment, the present paper has as main goal answer to the question: are the most innovative SMEs the most competitive ones? With this purpose the present prepare will be strutured as follows. After this introduction, in section 2 is presented theoretical framework based on a literature review about the main topics under study, seminal articles and state of art articles, followed in section 3 by the description of date and methodology that will support on section 4 the empirical application through a correlation analysis between innovative SMEs and competitiveness variables. The section 5 present the main conclusions and answer to our initial question.

2 Theoretical Framework

2.1 European Definition of SMEs

In the European single market, without internal borders, is essential to have a common definition of SME, in which are based the various support measures in order to improve their consistency and effectiveness and reduce distortions of competition. This aspect becomes very relevant when there is a great interaction between state members and European policies measures and incentives involving SMEs in regional development and research funding.

In 1996, the European Commission adopted a first Recommendation that established the first common European definition for SME. And in May of 2003 the European Commission adopted a new Recommendation 2003/361/EC of definition of SMEs, with effect from January 1st 2005. This review took into account the economic development since 1996 and the lessons resulting from the application of the definition of SMEs, such as the legal aspects that reduce the abuse, in particular state funds, Structural Funds and Boards of Research and Development.

This recommendation relates to all programs, community policies and measures implemented within the European Economic Area relating to SMEs and is addressed to the Member States, the European Investment Bank and the European Investment Fund.

According to the Recommendation 2003/361/EC, *SMEs* are defined as economically independent² companies with less than 250 employees and less than €50 million annual turnover and/or €43 million annual balance sheet. This recommendation comprises that an *enterprise* can be any institution (company of producer), regardless of its legal form is engaged in market through one economic activity. As well as define that *micro companies* are independent enterprises with less than 10 employees and less than €2 million of annual turnover and/or annual balance sheet. And *small companies* are independent enterprises with less than 50 employees and less than €10 million of annual turnover and/or annual balance sheet.

According to European Commission³, in EU's economic space, nine out of ten SMEs are micro-enterprises with less than 10 employees.

Different countries around the world have different definitions of SMEs (Ferraz & Pereira, 2017, 2018). Based on the number of employees, in EU based on the Recommendation 2003/361/EC a SME cannot have more than 250 employees, but in United States, NAFTA countries and Brazil SMEs may have up until 500 employees, or in South Korea or Japan where SMEs have up until 300 employees (Ferraz & Pereira, 2018).

² Be an autonomous enterprise means that the company does not own or is owned by a large company. A *large company* is a company with more than 250 employees or more than €50 million annual turnover and/or €43 million annual balance sheet.

³ In http://ec.europa.eu/smart-regulation/guidelines/tool_19_en.htm

2.2 Importance of SMEs in the modern economies and in the context of Europe strategy of 2020

Independently of the number of employees considered in each continent or country, the World Bank consider that the existence and development of SMEs has a central role in the promotion of economic growth and in the decrease of poverty of nations⁴. In the same way, the majority of the governments of the OEDC countries promote the entrepreneurship and the development of SMEs trough an enlarged set of policies and programmes (Luckács, 2005). And in EU SMEs are considered the engine of the European economy, in the way they are an essential source of jobs' creation, to create an entrepreneurial spirit and innovation in the EU and are thus crucial for fostering competitiveness and employment in a global competitive and changing environment.

The support to SMEs in EU is one of the European Commission priorities to the economic growth, the creation of jobs and social and economic cohesion. In EU the main policies and incentives are directed to fight the difficulties of SMEs, like funding to technology, to innovation, e-commerce, management and internationalization. In Korea these measures include also reduction of taxes and interest rates to loans to start new companies in rural areas (Luckács, 2005).

In the developed economies, SMEs have high rates of innovation in "high tech" and *skill-intensive*, the productivity is bigger in medium companies and the efficiency is lower in small enterprises (Ayyagari, Beck & Demirgüç-Kunt, 2005; Beck, Demirgüç-Kunt & Levine, 2005).

Some characteristics of SMEs, like their contribution to employment, innovativeness, export capacity, great flexibility, competitiveness and economic growth, the potential role in the development of entrepreneurial skills and innovation are highlighted in the study of Johnson and Turner (2003).

2.3. Relation between innovative SMEs and Competitiveness

The paradigm that ruled the competitiveness until the 1980s was based on comparative advantages. The main source of competitiveness was based on appropriations of allocation of labour and raw materials, capital and other inputs. A good business performance resulted from the advantages related to the low cost of productive resources.

The new competitive paradigm that currently characterizes the economy, , after the end of 1980s with the fall of the berlin wall, is based on globalisation and demand economy, e.g. are the needs of consumers that govern supply, in which the mobility of productive factors and the ability to combine them effectively dominates. Therefore, it is important to produce better, faster and at lower cost; minimizing features; designing companies as producers of value-added organizational systems that are based on knowledge, information, differentiation, sustainability and importance given to intangible factors. So, the mobility of production factors, the ability to effectively combine them and distribute value added assumes significance given the initial endowments in production factors.

⁴ In http://rru.worldbank.org/Documents/Other/MSMEDatabase/msme_companion_0706.pdf

Technological change, in particular the development of information and communication technologies (ICT), has brought new opportunities and challenges for companies around the world. These changes have increased the access to a wide knowledge base, as well as contributed to create market opportunities and innovative forms of industrial organisation. At the same time, the investment in human capital, through increased opportunities for education and training, and in skills development, has also led to a more qualified and more mobile, workforce (European Communities, 2002).

Most of economic opinion makers and policy makers agree that successful enterprises in the modern economy were developed through the application of knowledge and the generation of intangible assets. In recent years, the European Commission has given high priority to promoting SMEs (Ferraz & Pereira, 2016, 2017; European Communities, 2002). The SME dimension and economic relevance in EU is now an integral part of many Community policies and SMEs are key targets of many EU programmes. Europe's competitiveness is strongly linked to its position in innovation, entrepreneurship, knowledge based-economy and the diffusion of ICT.

The concept of competitiveness, at a macroeconomic level, becomes diffuse, pursuing as ultimate goal the sustainable growth of citizens' standard of living which results from productivity. At a microeconomic level, the concept of competitiveness has a clear definition, reporting to the competitive capacity of enterprises, and following as objectives: increasing productivity, optimizing profitability and increased market share.

A competitive economy can be characterized by high levels of efficiency and effectiveness translated simultaneously in the effective capacity to produce goods and services which meet the international markets, contributing to job creation and to the valued remuneration of production factors as well to improve, on a sustained basis, income and the standard of living of the population of a region, a nation or a specific zone (like EU). The competitiveness of an economy depends on the ability of governments to develop macro and micro policies with the purpose to improve the resources and the skills of domestic-based companies to allow these to be able to compete in a sustainable way in international markets and invigorate agglomeration economies likely to attract investors (national and international) and stimulate the development of indigenous entrepreneurship.

If the issue of national competitiveness is based on the ability of an economy, under conditions of free and fair market, produce goods and services that exposes the test markets, to enable simultaneous and sustained expansion of real income and the level of lives of its citizens in the long term, pursuing real convergence, then the increase in productivity is a necessary condition in order to obtain competitiveness. And a higher productivity contributes to increased standards of living. Since, are the companies that compete and not countries themselves, it can be considered that companies are the cell in which is based economic activity, therefore, the productivity and the expansion of the growth potential of the economy are a function of the competitive capacity of enterprises, their ability to create synergies and increase the added value of goods and services produced.

The European Charter for Small Enterprises has as main focus the factors that are considered critical to the development of SMEs: education for entrepreneurship; innovation; cheaper and faster business start-up; better legislation and regulation; increasing the availability of skills; improving on-line access; getting more out of the Single Market; taxation and financial measures; strengthening the technological capacity of small enterprises; making use of successful e-business models; developing top-class small business support; and developing stronger, more effective representation of small enterprises' interests.

So, we can say that exists a strictly relation between innovation and competitiveness. Based on this, in the next section we are going to investigate if the most innovative SMEs are in fact the most competitive ones.

3 Empirical Application: innovative SMEs versus most competitive SMEs

3.1 Data and methodology

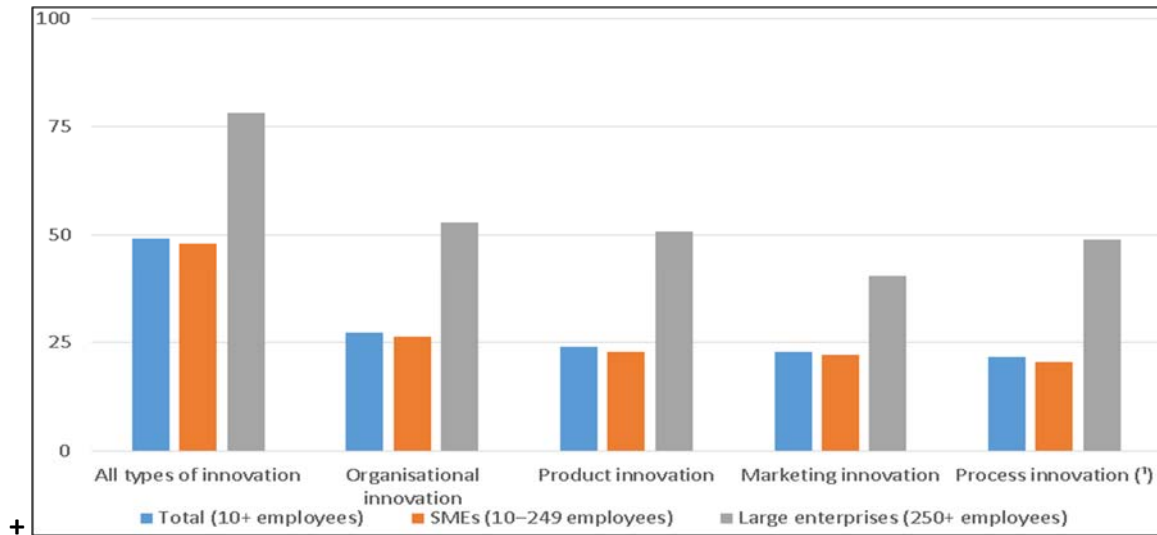
The variables used in our study were the Apparent Labour Productivity, as a proxy for Competitiveness, collected from the Eurostat Database on the Eurostat Structural Business Statistics; and the Innovation of products or services and Innovation of Marketing and Organisational, collected from the Eurostat on the European Innovation Scoreboard (EIS) for NACE Rev2. The period considered was 2009-2016 for innovation and 2014-2015 for competitiveness. The scores normalized for innovation were used.

About the methodology we followed a systematic literature review approach. Based on the main goal and on our question of starting research and in the literature review, we made a preliminary analysis of data, through a graphic and tables' analysis. Following we applied a correlation analysis and a regression analysis to investigate the relationship between innovation and competitiveness in SMEs.

3.2. Results and its discussion

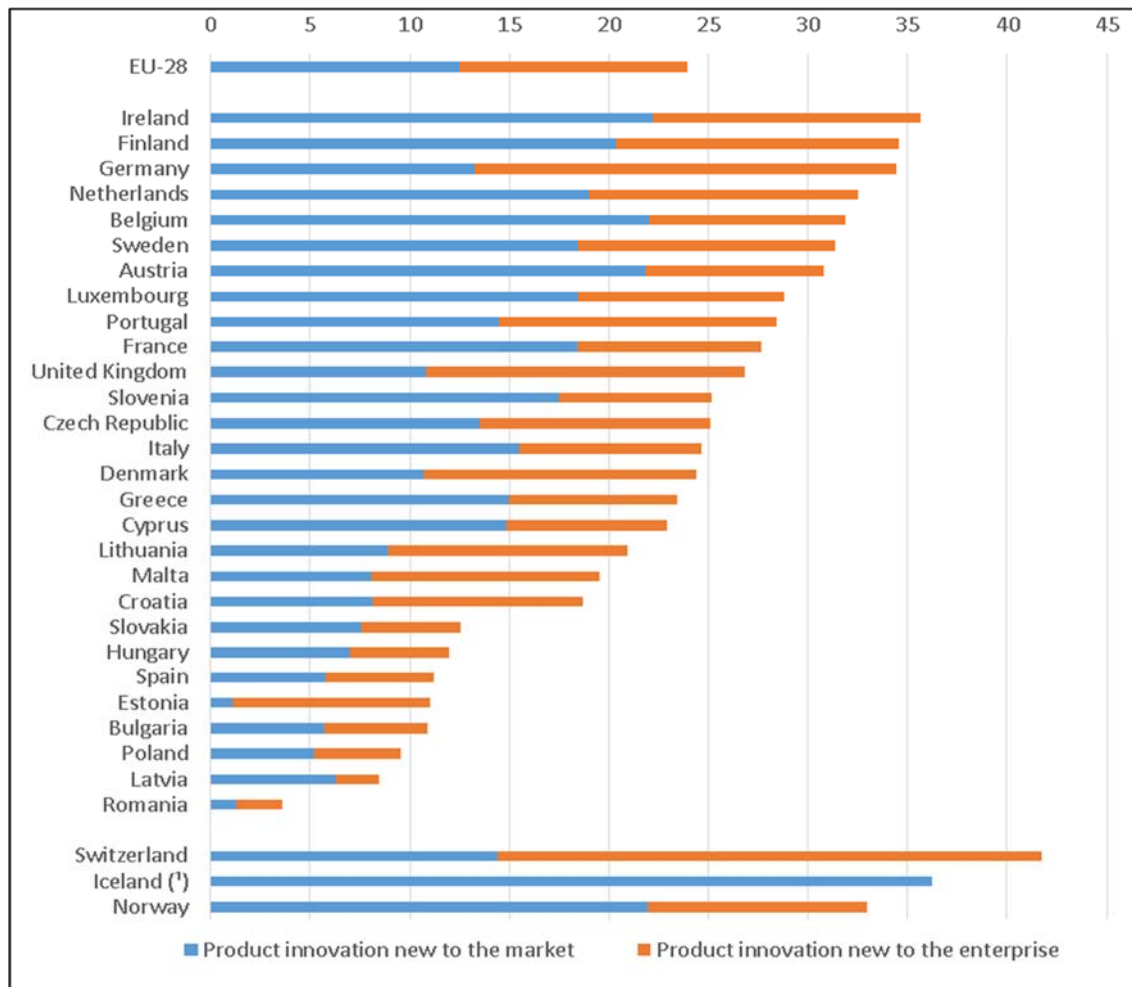
We begin with the analysis of the relationship between companies with different dimensions and the type of innovations. Considering besides the SMEs also the Large Enterprises (LEs) - that have more than 250 employees-, we can observe in Figure 1 that the LEs innovate more than the SMEs, and inside the SMEs are not significant differences between small companies and total SMEs. When analysed the type of innovations, SMEs are more innovative in organisational and product innovations (Figure 1).

The Figure 2 presents the product innovation new for the market and new to the enterprise by European country. And we can observe the rank of innovation by country.



(Source: Eurostat, European Innovation Scoreboard 2014-2016)

Figure 1 - Share of SMEs versus LA that are innovative, EU-28, 2014–2016



(Source: Eurostat, European Innovation Scoreboard 2017 Database)

Figure 2 – Product Innovation in European countries

GEO/TIME(year)	2009	2010	2011	2012	2013	2014	2015	2016
EU	97,3	100,0	100,0	93,1	93,1	80,5	80,5	81,8
Belgium	144,2	138,2	138,2	154,6	154,6	130,7	130,7	156,5
Bulgaria	25,2	38,0	38,0	13,3	13,3	7,2	7,2	9,3
Czech Republic	86,4	98,8	98,8	80,5	80,5	81,6	81,6	81,5
Denmark	102,4	110,7	110,7	118,8	118,8	94,8	94,8	97,9
Germany	176,0	179,5	179,5	157,9	157,9	131,4	131,4	127,6
Estonia	146,0	137,8	137,8	123,6	123,6	90,8	90,8	23,5
Ireland	137,2	130,9	130,9	126,3	126,3	102,3	102,3	145,5
Greece	109,4	109,4	109,4	109,4	109,4	76,4	76,4	97,7
Spain	75,8	67,2	67,2	57,7	57,7	28,1	28,1	28,9
France	86,9	86,9	86,9	80,3	80,3	88,0	88,0	101,4
Croatia	70,5	84,3	84,3	75,0	75,0	41,8	41,8	58,2
Italy	91,0	84,3	84,3	109,7	109,7	115,8	115,8	89,4
Cyprus	111,8	130,5	130,5	98,5	98,5	74,5	74,5	90,1
Latvia	10,9	22,9	22,9	10,2	10,2	16,4	16,4	0,0
Lithuania	33,6	43,2	43,2	33,3	33,3	18,0	18,0	93,8
Luxembourg	141,1	127,3	127,3	149,5	149,5	134,1	134,1	107,8
Hungary	21,0	21,2	21,2	11,9	11,9	4,0	4,0	13,7
Malta	60,4	60,4	60,4	61,1	61,1	86,7	86,7	63,8
Netherlands	90,5	84,7	84,7	140,1	140,1	124,6	124,6	133,5
Austria	154,7	119,0	119,0	123,8	123,8	102,4	102,4	124,0
Poland	36,6	24,3	24,3	7,0	7,0	5,1	5,1	5,9
Portugal	115,3	154,2	154,2	139,2	139,2	113,5	113,5	129,9
Romania	32,3	26,4	26,4	3,4	3,4	0,0	0,0	0,0
Slovenia	82,3	82,3	82,3	89,1	89,1	0,0	72,2	72,2
Slovakia	41,1	30,8	30,8	58,3	58,3	24,9	24,9	20,8
Finland	141,1	128,8	128,8	124,6	124,6	121,2	121,2	138,5
Sweden	123,8	123,5	123,5	137,2	137,2	120,5	120,5	122,7
United Kingdom	56,8	65,0	65,0	76,3	76,3	68,3	68,3	89,0

(Source: Eurostat, European Innovation Scoreboard 2017 Database)

Figure 3 – SMEs product or process innovations (percentage of SMEs) relative to EU in 2010

The Figure 3 represents the European SMEs' product or process innovations (in percentage of total SMEs) relative to EU average value in 2010. We can observe that in EU the innovations of product and process in SMEs increased from 2009 to 2010 and after 2011 decreased, verifying slight increase in 2016. In most of the European countries SMEs' innovations decrease after 2010, which could be explained by the crisis and for the high number of SMEs' bankruptcy verified in most of the countries. This is according the findings of some studies, like the ones of Filippetti and Archigugi (2010, 2011, 2013a, 2013b), that found that the investments in innovation declined in many European firms during the recent crisis, as an effect of recession on Europe, concluding that the crisis had a detrimental effect on entrepreneurship, innovation and business dynamism due to financial constraints.

When analysing in the European Innovation Scoreboard 2017 Database the indicator *SMEs introducing marketing or organisational innovations* verifies a similar trend, so we decided for the use of the indicator *SME's product and process innovations* in the present study, because this type of innovations are the most significant for SMEs and we conclude from the observation of data analysed in Figure 1.

For the analysis of the competitiveness, given by the apparent productivity, the analyse through the enterprises' dimension in micro, small, medium and large enterprises is not possible for all the European countries, once only are data available for the total of SMES and for the period between 2014 and 2015 and are several missing value for many countries. Between 2014 and 2015, most of the European countries and the EU (exception for Greece and Romania), in average, verify an increase in the SMEs competitiveness (Figure 4).

GEO/TIME	2014	2015	Var
EU	49	51	0,04
Belgium	71,0	72,8	0,03
Bulgaria	10,5	12,0	0,14
Czech Republic	23,9	25,2	0,05
Denmark	77,8	81,7	0,05
Germany	55,1	55,4	0,01
Estonia	25,7	25,6	0,00
Ireland	94,8	136,4	0,44
Greece	22,8	21,8	-0,04
Spain	40,4	41,3	0,02
France	57,2	62,6	0,09
Croatia	20,4	21,4	0,05
Italy	45,4	47,1	0,04
Cyprus	33,6	33,6	0,00
Latvia	16,3	16,7	0,02
Lithuania	16,0	16,8	0,05
Luxembourg	86,8	89,0	0,03
Hungary	20,7	21,4	0,03
Malta	33,1	38,1	0,15
Netherlands	59,1	60,8	0,03
Austria	62,4	64,3	0,03
Poland	21,5	21,7	0,01
Portugal	23,9	24,3	0,02
Romania	14,6	14,0	-0,04
Slovenia	32,1	32,7	0,02
Slovakia	21,5	22,6	0,05
Finland	59,2	61,7	0,04
Sweden	70,4	71,8	0,02
United Kingdom	65,6	73,3	0,12

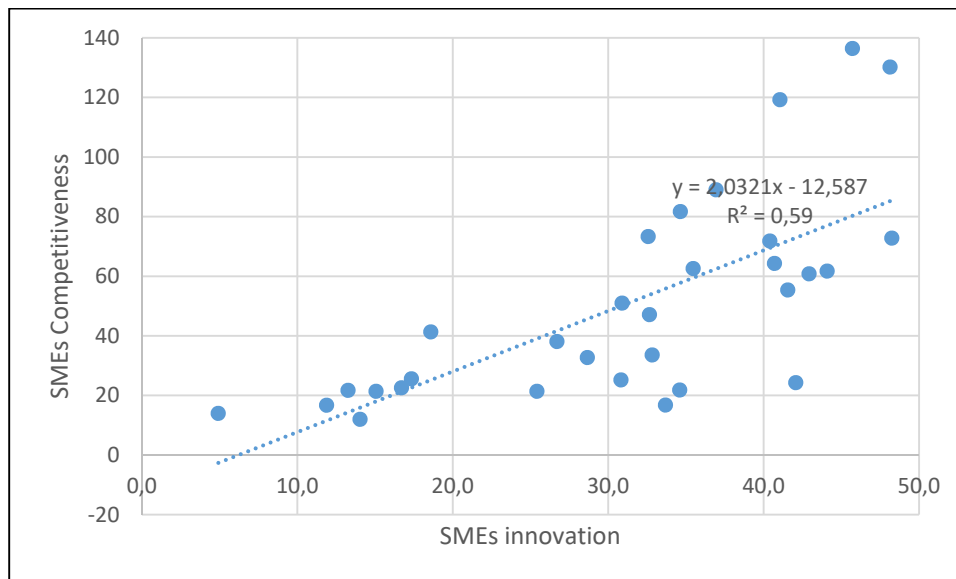
(Source: Eurostat, Structural Business Statistics 2017 Database)

Figure 4 – SMEs competitiveness (given by the apparent labour productivity), 2014 and 2015

For the correlation between SMEs Innovation and SMEs Competitiveness was obtained a value of 0,71, that we can consider a significant value. And for the regression analysis we used a graphic to illustrate and allow an easy perception of the relationship between the two variables under analyse, that was used for apply a trend line. The linear regression was applied and obtained a relation of $SMEs\ Competitiveness = 2,0321Innovation - 12,587$, with a determination coefficient of $R^2 = 0,59$ (Figure 5). This means that SMEs' Competitiveness is

explained by Innovation of product and process, occurring a positive relationship, e.g. when innovation increases SME competitiveness will increase.

For the analysis of the Figure 5 we can conclude that countries with SMEs most innovative are most of the times also the ones with the most competitive SMEs.



(Source: Eurostat, European Innovation Scoreboard and Structural Business Statistics 2017 Databases)

Figure 5 – Relation between Innovation and SME Competitiveness

4. Conclusions

The purpose of the present paper was study European innovative SMEs and investigate if the most innovative SMEs are the most competitive one, based on the apparent productivity of labour as a proxy for competitiveness. With this purpose a systematic literature review approach was followed, based on the main goal and on our question of starting research and in the literature review, we made a preliminary analysis of data, through a graphic and tables' analysis, and applied a correlation analysis and a regression analysis to investigate the relationship between innovation and competitiveness in SMEs.

The paper based on the theoretical framework of Economics of SMEs. According to this approach the SMEs are the locomotive of the economic growth, progress and social inclusion of EU, which is supported by the Europe strategy 2020 initiatives and flagships. Under this approach and European strategy innovation is crucial to increase the sustainable competitiveness of SMEs and European growth.

The results obtained a significant relation between innovative SMEs and their competitiveness, and allowed to answer positively to our initial research question that are the most innovative SMEs the most competitive ones. However, there are some exceptions. And this might be explained by the recent European crisis, with the effects of the recession in many European countries, characterized by many business bankruptcy and by an uncertainty environment that took to the decrease of investments in innovation, which is in accordance with several studies.

But this particular aspect, if we based on what Schumpeter (1939, 1942) postulated about crises, saying that crises were seedbeds of innovation and entrepreneurship, innovations developed during crises can stimulates the *creative destruction* that launch new technologies, remake existing industries, and give birth to entirely new ones - setting in motion new rounds of economic growth. This connection between innovation and economic growth, where the clustering of radical innovation can boom clusters driving the business cycle to an expansion path.

The present paper has also as purpose to contribute to the scientific knowledge of the concepts under study and to the knowledge about the relevance and significant contribution of the innovation on product, and process, but also on marketing and organisational and other forms of innovation to SMEs competitiveness. This relationship has a key role for the European competitiveness. However, this paper have some limitations: the scarce data about SMEs competitiveness (apparent labour productivity) and innovation. So, a way to increase the knowledge about the topics under study is a continuum investigation about the variables that determine innovative SMEs and its competitiveness. For other side, a more complete work should be done to study European innovative SMEs and investigate if the most innovative SMEs are the most competitive one according to different dimensions of companies, industrial sectors and also investigate this relationship based on the internationalisation, wages, investment and creation of employment.

References

- Acs Z. J. and Audrestch D. (1990), *The Economics of Small Firms – a European Challenge*, Kluwer Academic Publishers, London.
- Ayyagari, Meghana; Thorsten Beck and Asli Demirgüç-Kunt (2005), Small and medium enterprises across the globe: a new database, *Policy Research Working Paper Series*, 3127, August. In http://siteresources.worldbank.org/DEC/Resources/84797-1114437274304/SME_globe.pdf
- Beck, Thorsten; Asli Demirgüç-Kunt and Ross Levine (2005), SMEs, growth, and proverty, *NBER Working Paper No. 11224*, March. In <http://www.nber.org/papers/w11224>
- European Communities (2002), *SMEs in Europe: Competitiveness, Innovation and the Knowledge-driven Society*, European Commission, Office for Official Publication of the European Communities, Statistic Books, Luxembourg.
- Ferraz, Diogo E. & Pereira Elisabeth T. (2016), "The Economic Role of Small Knowledge Intensive Firms in European Countries", *Proceedings of International Conference TAKE 2016 – Theory and Applications in the Knowledge Economy*, University of Aveiro, Portugal, 6-8 July 2016, pp.516-532.
- Ferraz, Diogo E., & Pereira, Elisabeth T. (2017). The Importance of Small Knowledge Intensive Firms in European Countries. In Wach, K., Knežević, B., & Šimurina, N. (Eds.), *Challenges for international business in Central and Eastern Europe* ("Przedsiębiorczość Międzynarodowa, International Entrepreneurship", Vol. 3, No. 1. Kraków: Cracow University of Economics, pp. 85-108.
- Ferraz, Diogo E., & Pereira, Elisabeth T. (2018). The Economic Role of Small Knowledge Intensive Firms in European Member States, *International Journal of Knowledge-Based Development (IJKBD)*, (Forthcoming).
- Filippetti, A; and Archibugi, D (2010), "Innovation in Times of Crisis: The Uneven Effects of the Economic Downturn across Europe", MPRA Paper No. 22084, April (in <http://mpra.ub.uni-muenchen.de>).
- Filippetti, A; and Archibugi, D (2011), *Innovation and Economic Crisis: Lessons and Prospects from the Economic Downturn*, Routledge, London and New York.

Filippetti, A; Archibugi, D, and Frenz, M. (2013a), "The impact of the economic crisis on innovation: Evidence from Europe", *Technological Forecasting and Social Change*, 80 (7), 1247-1260.

Filippetti, A; Archibugi, D, and Frenz, M. (2013b), [Economic crisis and innovation: Is destruction prevailing over accumulation?](#) *Research Policy*, Volume 42, Issue 2, March, 303–314.

Johnson, D. and Turner, C. (2003), *International business: themes and issues in the modern global economy*, Routledge, Chapter 6, pp. 126-141.

Lukács, Edit (2005), The Economic Role of SMEs in World Economy, Especially In Europe, *European Integration Studies*, Miskolc, 4, 1.

Pereira, E.T. (2007), "The Internationalisation of Portuguese SMEs", *International Journal of Business and Globalisation*, Vol. 1, No. 3, November 2007, pp. 369-390.

Schumpeter, J.A. (1939) *Business Cycles A Theoretical, Historical, and Statistical Analysis of the Capitalist Process*. McGraw-Hill, New York.

Schumpeter J.A. (1942), *Capitalism, socialism and democracy*, Harpers & Bro, New York.

Consumer Satisfaction and Retail

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Retail industry is an important part of each national economy (in some European countries even 25% of all active companies are operating in this industry). The retail industry is the most sensitive to changes in consumer behaviour. It is the industry that firstly responds to both positive and negative trends in the environment. Therefore, retailers are constantly under pressure to assess consumer satisfaction and to adjust to customer needs rapidly. The recession and the rapid technological innovation puts even greater challenges in front of contemporary retailers because consumers are more and more sensitive to prices, on one hand, and they are excessively informed, on the other hand. So it gets harder and harder to maintain competitive advantage in satisfaction of their needs. The aim of this stream is to address the necessity for constant innovation and rapid knowledge creation cycles in companies in retail industry which enables fast and efficient satisfaction of consumer needs.

Mobile applications of retail banks - the dynamics of development and its determinants

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Abstract: The article contains identification of the dynamics of development of mobile applications of retail banks in Poland and its determinants. Characterizing examples of retail banks' use of mobile applications in shaping service offerings. Popularity of this offer of retail banks among customers. An indication of the determinant of the use of mobile apps especially related with customers and their preferences, expectations and the negative attitude and anxiety about security and privacy. The article uses methods of reviewing and analyzing critical, descriptive and comparative content in available domestic and foreign sources of the literature and reports on the issues of the mobile banking market.

Keywords: Innovations, mobile banking applications, retail banks

1 Introduction

We can observe an increasingly competitive banking sector with increasingly demanding clients. Innovations help banks and financial services companies sharpen their competitive edge with the power of mobile technology. Mobile banking has represented a breakthrough in terms of remote banking services (Tiwari, Buse and Herstatt 2007). Transactions through mobile banking may include obtaining account balances and lists of latest transactions, electronic bill payments, and funds transfers between a customer's or another's accounts. Mobile banking is a service provided by a bank that allows its customers to conduct financial transactions remotely using a mobile device such as a smartphone or tablet. Unlike the related internet banking it uses software, usually called an app, provided by the financial institution for the purpose.

Retail banks convert the Internet and mobile applications or apps into the most effective channel for offering banking products and services to clients. They create and retain close ties by providing branchless banking to individual customers (Laukkanen and Lauronen 2005). With a custom mobile banking app, retail banks can provide better customer experience by delivering flexibility and convenience of the essential banking operations right from mobile devices (Riivari 2005). Today's customers are becoming ever more tech-savvy and concerned with their online banking security. So any financial transaction requires tough security measures to protect the details and finances of the customers who choose to use these apps for their banking.

2 Methodology

The goal of the paper is to present dynamics of development of mobile applications of retail banks in Poland and to indicate its determinants, especially related with customers. The aim is to show the preferences of retail banking customers related to the offer of services based on mobile applications. It is also important to identify the limitations resulting from the negative attitude and anxiety about security and privacy.

The article uses methods of reviewing and analyzing critical, descriptive and comparative content in available domestic and foreign sources of the literature and reports on the issues of the mobile banking market. In the paper the analysis will be based on the example of selected retail banks operating in Poland (the results of research and observation conducted on the market retail banks in Poland in the years 2014 – 2018).

Empirical analysis in the article were based in particular on the results of recent market research of mobile banking in Poland. Included reports BANK.JEST.MOBI 2016, BANK.JEST.MOBI 2018, PRNews, Polska_jest_mobi_2018, "Jestem mobi 2017". In order to present the broader context of the phenomenon also used the results of research carried out on the European market by IPSOS on behalf of ING (ING International Survey Mobile banking), Kantar TNS, Deloitte, "Digital, mobile i social media 2018 (Poland)". Selected issues are presented in tabular and graphic form.

3 Mobile banking applications - theoretical base

Initially, mobile applications were supposed to be only a complementary channel of access to the account with limited number of available operations (Bankowość mobilna 2015). Over time, they started to develop their functionality and compete with older and already more traditional online banking. Currently a lot of mobile applications offer more than desktop versions of transaction systems (Shaikh and Karjaluoto 2015). Apart from core functions such as account services or ordering transfers, banking applications allow to make payments in shops, scan invoices, buy tickets for public transport, buy insurance and make instant transfers to telephone numbers among others (Borcuch 2016).

Mobile banking apps allow users to, among other advantages, access their accounts from any location and at any time (Barnes and Corbitt 2003). Certain mobile banking applications allow their users to pay for products simply by touching their phones to special points at checkout with the aid of "payment stickers" attached to their phone. So they allow the phone to serve as a mobile wallet. This is big advantage over traditional banks, especially for young customer from generations Y. However, many older customers remain uncertain due to its security.

The convenience and security of these innovative products has become one of the many tools to attract new banking customers and retain existing clients (Luarn and Lin 2005). This leads to healthy competition, and to new advances in what these apps, and the customers who use them, can do. With a mobile banking app, banks can improving customer experience through personalized banking and a convenient access to loyalty programs. With stronger personal ties, banks foster customer retention. Mobile apps can provide selling more with targeted new products and services and will embrace new cross- and upselling opportunities. Banks can also reducing service costs by getting cheaper mobile transactions (Nielsen and Budiu 2013).

Convenient mobile application can replace desktop transaction service for customers. Reports of PRNews.pl show that nowadays the banks have 2.2 million mobile only customers. They are people who do not log in on their accounts from computer level because all operations are made on smartphones. The group of *mobile only* customers is growing thanks to very good applications. Majority of programs offered by banks can already now replace the standard Internet banking because the most essential functions used by customers daily are available on telephone. Efforts and activity of banks in implementation of these solutions result from the fact that they are interested in transition of customers to mobile channel. Consumers always have telephones with them which offers the customers using such applications the comfort sought by them. Furthermore, the logging-in process, especially with the use of biometrics is much faster and increasingly more secure. The table 1 shows advantages of banking applications.

Table 1: Advantages of banking applications on smartphones

Feature	Advantage
Variety	A broad choice of options depending on the character and purpose – e.g. applications that facilitate household budget management – current update of expenses, convenience of access to loyalty programs, support for savings for a specific purpose, etc.
Mobility	The possibility to use in any place in the world, at any time, with no need to have access to the computer; majority of applications, e.g. that serve updating current expenses, cataloguing the shopping or planning savings, function without the necessity to connect with the Internet
Fast access	Programs operating in real time work with operational systems of telephones and optimise the process on ongoing basis while being guided by convenience and benefits for customer
Convenience	Functional payment for shopping, with no need to carry a purse, cash or a debit card; the lack of the need to remember and enter logins and passwords is also an advantage
Intuitiveness	Simplicity of operation allows it to be used by people who have problems with using smartphones – high level of interaction with the user, which facilitates the use of their functions; intuitive interface that allows for easy use of the application

Among the barriers that limit the acceptance of mobile banking can be identified: (Laukkanen and Cruz 2008; ChauShen Chen 2013):

- barrier of use that results from the limitations of ergonomics and computing power of mobile device
- added value barrier - according to the same opportunities to pursue other functionality, including a more ergonomic and cheaper channels
- risk barrier - threats related to the failure of technologies, especially in the area of unauthorized access to the client's financial resources
- tradition barrier - according to customers' attachment to traditional forms of contact with the bank
- image barrier - results from the perception of mobile solutions as very complicated and difficult to use

The right information policy of banks directed at users (advice, tips, education) may be a tool to limit these barriers. It is most effective in reducing barriers to use, and a little less removes the barrier image, values and risks (Laukkanen and Kovaniemi 2010).

4 Mobile banking in Polish sector

Mobile banking in conditions of Polish sector can be considered “mature”. Activation of the information service based on currently outdated WAP technology in 2000 by Wielkopolski Bank Kredytowy (BZ WBK now) was the first step in its development. Providing access to the first mobile applications written for iOS system was the turning point. In 2009 it was done by Raiffeisen Bank when it made Mobile Bank program available.

Nowadays practically every bank operating in Poland has services based on mobile solutions in its offer. They use special applications for customers that are programs installed in mobile operational systems, i.e. Android, iOS, Windows Phone, Symbian or BlackBerry (Table 2)

Table 2: Availability of banking applications in Polish banks

BANK	IOS	Android	Windows Phone	BlackBerry	Symbian
Alior Bank	V	V	V	-	-
Bank Millennium	V	V	V	-	-
Bank Pekao	V	V	V	V	V
BZWBK	V	V	V	-	-
Citi Handlowy	V	V	-	-	-
ING Bank Śląski	V	V	V	V	-
mBank	V	V	V	-	-
PKO BP	V	V	V	V	V
Raiffeisen Polbank	V	V	V	-	-
Getin Bank	V	V	V	-	-

Applications vary in terms of the number of offered functions and graphic positioning of specific elements on mobile device display, the so-called user interface. They allow for making financial transactions, including transfers, orders, payments and withdrawals. Additionally, some banks make it possible for their customers to take instalment loans, credit loans or even order a credit card through applications. However, in the latter situation it is necessary to go to an appropriate branch where they sign a traditional paper contract.

At the end of 2017 nearly 5.6 million customers used mobile banking applications in Poland. Transactionability grew by 85%, but customers were opening fewer mobile deposit accounts than a year before. At the end of 2017 banks had 9 million users of mobile banking. This number includes the users of applications, lite services, RWD and customers who log in from mobile devices to standard Internet banking systems. According to data provided by banks, there were 5.6 million users of mobile applications (the number can be slightly higher because several small banks, i.e. Idea Bank, Nest Bank and BOŚ are not included in the list). PKO BP that has 1.3 million active users of application is the leader. Such a user represents people

who log in to a program at least once a month in a given quarter. mBank is in the second place with the number reaching 1.1 million. In the previous quarter the bank was in the first place. ING Bank Śląski whose application is used by 868 thousand customers is the third in the ranking (Table 3).

Table 3: The number of active users of the mobile application

Bank	IV kw. 2012	IV kw. 2013	IV kw. 2014	IV kw. 2015	IV kw. 2016	IV kw. 2017
PKO BP	236 624	427 542	625 244	1 328 905	1 652 460	1 281 937
mBank	300 000	724 096	892 000	1 092 440	1 327 555	1 139 450
ING Bank	98 000	244 000	420 146	500 000	1 048 486	867 443
BZ WBK	124 819	239 000	483 472	666 278	974 336	711 614
Pekao	201 000	373 063	595 926	1 014 647	1 495 681	ok. 470 000
Millennium	51 395	79 062	Bd.	402 689	595 756	469 000
Alior Bank	bd	107 511	41 750	115 054	128 809	159 495
eurobank	bd	bd	49 799	90 000	111 707	96 492
BGŻ BNP Paribas	bd	bd	77 969	118 621	35 589	82 000
Credit Agricole	bd	bd	bd	0	45 034	74 165
Raiffeisen Polbank	17 200	23 300	27 500	52 501	68 210	72 424
Citi Handlowy	111 125	170 000	66 000	74 959	86 200	62 094
T-Mobile UB	bd	bd	50 904	60 000	60 875	61 517
Plus Bank	52 596	57 784	bd	13 947	27 750	28 791
Razem:	1 094 857	2 445 358	3 280 915	5 530 041	7 687 918	5 576 422

Source: Own study based on: PRNews.pl

Data from the banks show that transactionability of the users of application is growing. The customers conducted in total 44 million financial transaction with their use in the 4th quarter of 2017. This is a growth by 24 million in comparison with 4th quarter of 2016, i.e. by 85% (Tab. 4).

Table 4: The number of financial transactions made from the mobile application in a given quarter

Bank	IV quarte. 2016	IV quarter 2017	2016-to-2017 change	2016-to-17 change (%)
PKO BP	4 987 696	14 061 647	9 073 951	181,9%
ING Bank Śląski	8 466 971	12 670 296	4 203 325	49,6%
Bank Millennium	4 606 544	6 864 351	2 257 807	49,0%
BZ WBK	3 900 427	6 802 906	2 902 479	74,4%
Eurobank	502 143	756 277	254 134	50,6%
Raiffeisen Polbank	150 726	697 287	546 561	362,6%
Credit Agricole	304 873	653 268	348 395	114,3%
Alior Bank	482 489	542348	59 859	12,4%
BGŻ BNP Paribas Bank	160 889	498 000	337 111	209,5%
TMUB	116 321	419 599	303 278	260,7%
Citi Handlowy	229 773	208 324	-21 449	-9,3%
Plus Bank	39 442	78 424	38 982	98,8%
Razem:	23 948 294	44 252 727	20 304 433	84,8%

Source: PRNews.pl

The number of opened deposit accounts decreased. In the last three months of 2017, the customers opened in total 154 thousand deposits, i.e. by 22 thousand less than in the same period of the previous year. This represents a 10% decline, which can be explained by decreased interest rate on deposits to standard levels after attractive promotional offers for mobile deposits at the beginning finished.

5 Comparing of mobile apps offered by retail banks

While assessing attractiveness of mobile programs offered by banks, several basic categories constituting functionality of applications can be taken into considerations. Such a procedure was performed by bankier.pl portal including methods of logging in and authorisation of transaction (maximum 4 points), methods of making the payment via telephone and withdrawals from ATM (e.g. HCE, withdrawals from ATMs – Blik or PeoPay, transfers to mobiles and payments with the use of QR codes or OCR function to scan invoices) (maximum 10 points) as criteria of evaluation. Additional functions associated with financial management such as the possibility to open deposits and saving accounts, foreign currency accounts, possibility to buy and sell foreign currency, applying for payment cards and loans at click,

possibility to check the balance before logging in and card management (temporary blocking, cancelling cards, changing limits) (maximum 20 points)¹ are an important category of evaluation. Additional services including non-standard services such as the possibility to buy tickets through application, buying insurance, registering receipts or loyalty cards (maximum 14 points) represent a complementary criterion of evaluation.

Comparing the offer of banks according to these criteria, mBank and BZ WBK are ex aequo leaders in the sector. They both offer well-developed applications with options going beyond standard functions of mobile banking. mBank application offers all payment options available on market, i.e. HCE, Blik or withdrawal from ATMs. Less standard options include the rate of the speed of expenses, full operation of securities account, creation of saving targets or the possibility to connect the card to Google Pay without its physical possession. On the other hand, BZ WBK has a financial passage connected to the application. Its customer can buy tickets for public transport, insurance, book a taxi or even flowers. It is possible from the level of BZ WBK application to switch off the magnetic strip of the card or contact with counsellor through video call (Table 5).

Table 5: The best mobile apps of polish banks

Lp.	Bank	Metody logowania i autoryzacji transakcji	Płatności aplikacją i wypłaty gotówki	Zarządzanie finansami	Usługi dodatkowe	Suma punktów
1	mBank	3	10	16	9	38
	BZ WBK	2	10	16	10	38
2	ING Bank	3	8	20	6	37
3	Bank Millennium	3	10	14	8	35
	Pekao	4	6	18	7	35
	PKO BP	3	10	16	6	35
4	Alior Bank	3	10	18	1	32
	TMUB	3	8	16	5	32
5	Getin Bank	3	8	14	4,5	29,5
6	Orange Finanse	2	8	10	5	25
7	eurobank	2	2	12	1	17
8	Citi Handlowy	2	4	6	3,5	15,5
9	BGŻ BNP Paribas	3	6	4	0	13
10	Envelo Bank	1	2	5	3	11
11	Credit Agricole	1	0	4	3	8

Source: Bankier.pl, banks, state by day 13.03.2018 r.

¹ Core functions, including the possibility of checking balance, history or transfer to the account in another bank are now offered by all banks.

ING Bank Śląski is ranked in the second place. It integrated its program with RWD system. This means that the customer has access to all functions of desktop system version in its application. Apart from this, it has a broad offer of services typical of mobile programs, i.e. HCE payments, Blik, logging in with the fingerprint or registering receipts.

Programs offered by Millennium Bank, Pekao and PKO BP are in the third place. Each of these programs has unique functions but they do not have for example foreign currency exchange offices (PKO BP, Millennium) or Blik (Pekao) in their offer. Among interesting additional functions, the application of Millennium Bank is the only in the market that allows to buy a vehicle insurance. In Pekao program, transfers can be authorised by a fingerprint, and Blik cheques can be found among unique functions of IKO.

In May 2016 the report BANK.JEST.MOBI 2016 was published. It was a result of the research project that was focused on the analysis of banks in terms of various criteria important from the point of view of customers' needs that make the banks aspire to be perceived as mobile. It comprised the banks operating in Poland, offering savings-and-checking accounts for individual customers that have mobile application (there are 20 such banks) and/or transaction service in the version optimised for smartphones (24 banks). Distinguished mobile applications included (<http://www.mobiletrends.pl/8-polskich-bankow-wyroznionych-mobilnosc/>):

- Millenium Bank app - available on all operating systems and as the only one it has the version for Samsung Gear 2 watch, Sony SmartWatch 2, Apple Watch and watches with Android Wear system; nominated in Mobile Trends Awards 2015.
- **mBank** app – advanced application (e.g. logging in with Touch ID or 3D Touch service); possibility to open an account and complete mobile activation from the level of smartphone without the need to log in to the system of online banking. The winner in the category of Mobile Banking in Mobile Trends Awards 2015 and 2014.
- **Bank Zachodni WBK app – the bank that is most aspiring to be perceived as available for the disabled (distinguished for availability in terms of communication – it offers the possibility to contact with the bank in several ways with the option of dedicated contact for the deaf), nomination for Mobile Trends Awards 2015.**
- **SMART Bank and BIZ Bank app – two banks that are the only that use still not popularised biometric solutions, i.e. voice applications (logging in, checking the balance, making transfers and reaching the account history).**
- **ING Bank Śląski** app – the bank that is liked most by customers and that experiments with the concept of hybrid application in which RWD transaction service is implemented in the native application.
- **PKO Bank Polski** with IKO application that best supports the 3P idea (from Polish words *Piękne* [Beautiful], *Proste* [Easy] and *Praktyczne* [Practical] mobile solutions). Exceptionally easy and useful with the option of personalisation based on its users.

6 Popularity of banking mobile Apps among individual clients in Poland and its determinants

In 2018, 38.14 million people already live in Poland, of which 78% use the Internet (29.75 million), almost half actively use social media and 37% use smartphones to use social media. At present, there are 1.3 SIM cards per one inhabitant of Poland. These percentages are very similar to the results for Europe (Digital, mobile i social media 2018 (Poland)). This confirms other findings. According to the survey conducted by IPSOS in 2017, Poles have mobile devices slightly less frequently than people in Europe². 83% declare that they have a smartphone, and over a half have a tablet (54%). This is only a few percentage points less than on average in Europe. An ordinary mobile phone is an exception; 46% Poles admit they have it, which is 15% more than in the case of people in Europe. At the same time, Poles use mobile devices to make banking operations more actively than people in Europe, i.e. 65% owners of smartphones and 59% owners of tablets use them to execute banking operations. On average in Europe these rates reached 57% (smartphone) and 50% (tablet) respectively. In this respect, only Turks are ahead of Poles (Table 6).

Table 6: Use mobile devices to make banking operations

	Smart phone	Tablet	Wearable device	Mobile phone	Smart TV
European consumer	57%	50%	21%	18%	10%
Turkey	80%	63%	39%	32%	20%
Poland	65%	59%	31%	26%	12%
USA	65%	55%	34%	20%	15%
Spain	64%	47%	15%	26%	10%
Netherlands	64%	42%	16%	13%	4%
Czech Republic	58%	44%	11%	19%	5%
France	57%	55%	25%	17%	13%
United Kingdom	57%	46%	23%	11%	7%
Australia	55%	48%	13%	14%	7%
Romania	53%	38%	25%	15%	6%
Belgium	53%	43%	18%	14%	8%
Italy	49%	48%	10%	14%	9%
Austria	47%	49%	14%	13%	5%
Luxembourg	43%	46%	12%	12%	5%
Germany	38%	41%	11%	9%	5%

Source: ING International Survey Mobile banking – the next generation May 2017

In 2013, more than half of the users of mobile banking declared that "mobile banking is just an addition to internet banking (" The role of mobile finance in the lives of Poles "). Since then, the number of people using mobile banking is growing very rapidly - in 2017 it reached 37% (Figure 1).

² The current edition of the research was conducted by IPSOS in 13 countries including Poland, Austria, Belgium, Czech Republic, France, Spain, Holland, Luxembourg, Germany, Romania, Turkey, Great Britain and Italy in February 2017. Computer-assisted web interview was the research method (CAWI). The research sample comprised 12 662 respondents, including 1004 from Poland. The sample was representative by age, sex and region of residence.

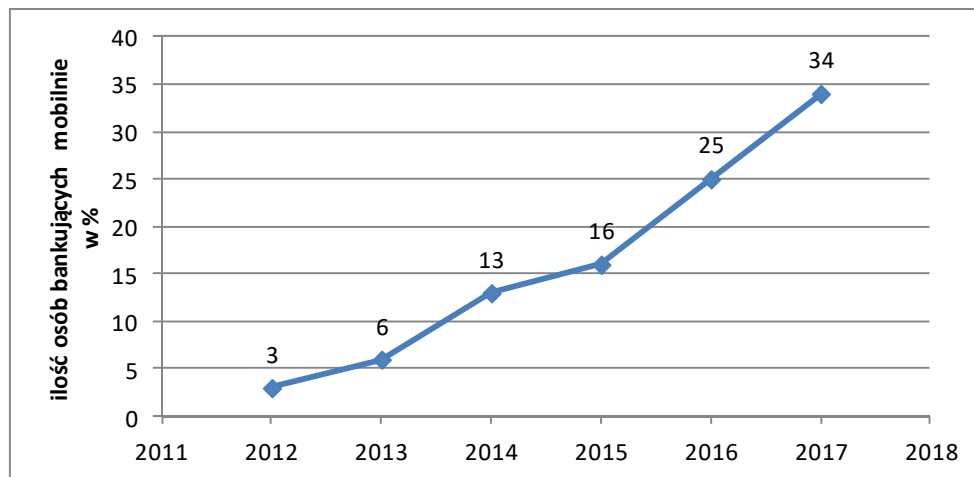


Figure 1: People using mobile banking in the years 2012-2017 (i%)
 Source: Raport Polska_jest_mobi_2018, Kantar TNS

Mobile customers currently have a choice of three channels of access to the bank via smartphone. Native applications that can be downloaded from software markets enjoy the largest popularity nowadays. Applications for two leading operational systems, i.e. Android and iOS are available most often, even though some banks also provide access to the software for Windows (Figure 2).

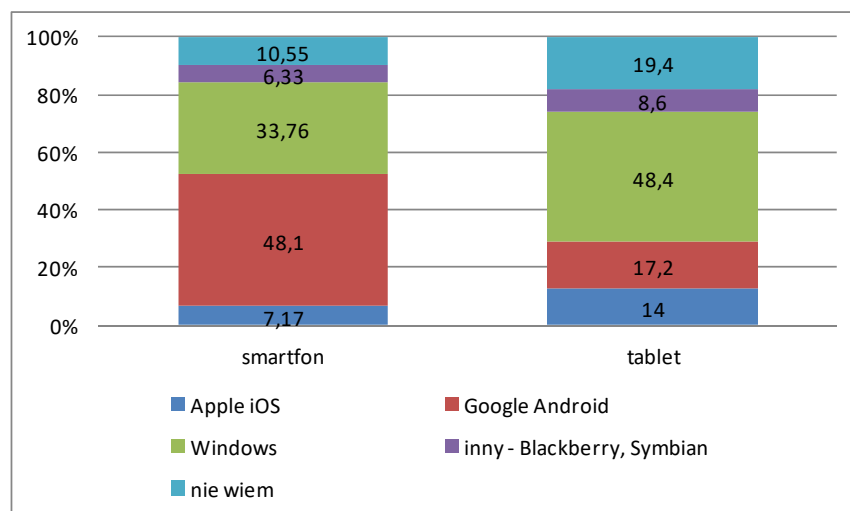


Figure 2: Operating systems used by customers for mobile banking
 Source: Own study based on: Bankowość mobilna 2014

Owners of telephones with other operational systems can use lite services or their newer version of RWD. Unfortunately, not all banks provide access to this service. Systems written in RWD technology are applied for example by ING Bank Śląski, Millennium Bank, Eurobank or Raiffeisen.

The results of the survey entitled “Mobile banking 2014” show that mobile banking is most frequently used at home even though, thanks to such mobile devices as laptop, tablet or smartphone, the access to the bank account and transaction system of the bank is possible from any place (Table 7).

Table 7: Using mobile banking on smartphone and tablet

Method	%	
	smartphone	tablet
Using a special application	46,4	19,9
Through the website	45,5	27,7
I do not use mobile banking on this device	21,4	56,7

Source: Own study based on: Bankowość mobilna 2014

As many as 93.6% respondents use mobile banking in the privacy of their home, using tablets for this purpose, and 82.7% using smartphones. Among smartphone and tablet users, the workplace is found in the second place among locations in which people use mobile banking applications. The workers use smartphones for this purpose in 57.4% cases and their tablets in 34.4% cases.

In successive places in the survey they pointed to using mobile banking while commuting to work or from work (18.3% of indications for tablets and 45.2% of indications for smartphones), on holidays (32.5% of indications for smartphones and 24.7% for tablets) and in restaurants or cafes where the greatest difference between users of various mobile users is noticed – such an answer was given by 4.3% users of tablets and by 26.2% users of smartphones.

The survey “Barometr Finansowy” (“*Financial Barometer*”) conducted by ING Group in 2015 showed that Polish users of mobile banking use it:

- at home - 41%,
- while doing shopping - 16%,
- on holidays - 12%,
- in workplaces - 10%.

Even though thanks to such mobile devices as laptop, tablet or smartphone, customers can have access to their bank account and transaction system of their bank from any location, the concerns about security of finances represents some barrier. At home, they can use a secure Wi-Fi network, whereas in a café or while doing shopping, security of the networks is not as good, and the risk of access data theft is greater.

The need to provide appropriate software for telephones was already indicated several years ago by Urząd Komisji Nadzoru Finansowego [KNF – *Office of Polish Financial Supervision Authority*] while emphasising that contact with banks via smartphones and tablets is significantly more exposed to attacks of cyber-thieves than in the case of traditional computers. Relevant education in this sphere is even more important because the research of Fundacja Kronenberga [*The Kronenberg Foundation*] shows that a half of respondents considers online and mobile banking so secure that they did not apply basic account security measures. On the other hand, the research conducted by the research company Smartscope in 2017 shows that 40% respondents, the owners of smartphones, did not think about using anti-virus program in the mobile phone.

Owners of mobile phones in Poland use them firstly to check the balance of their account or transaction history (65%). Over a half pay the bills with the use of them (51%), and 44% make transfers between own accounts. Every third person sends money to family or friends with

the use of a mobile device and every fourth person searches for the nearest ATM or a bank branch (Figure 3).

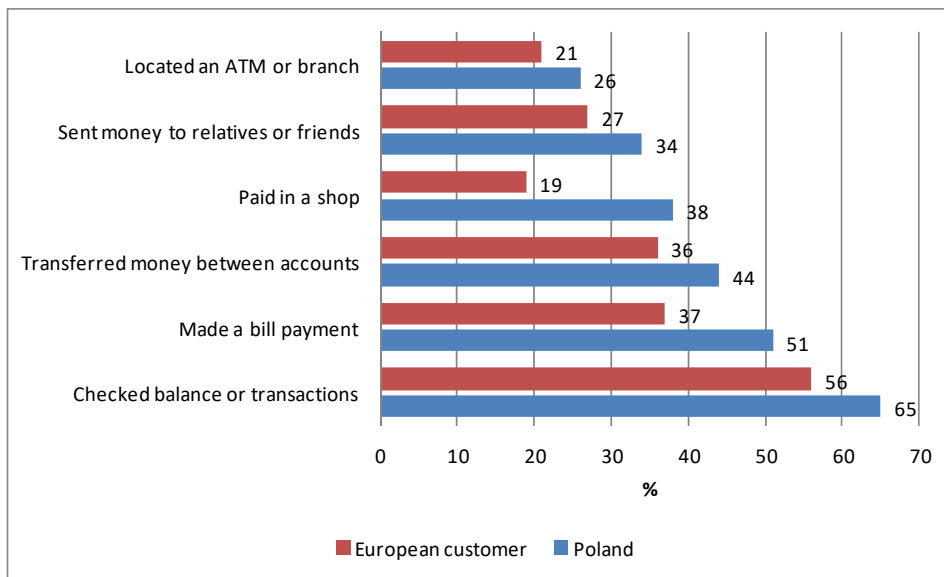


Figure 3: Using your mobile phone/tablet/wearable device, have you done any of the following in the past 12 months?

Asked to smartphone, tablet and wearable owners. Multiple answers possible. Those who replied “none of these” not shown

Source: Own study based on: ING International Survey Mobile banking

Both Poles and citizens of other countries indicate convenience of this solution as the main reason why they started to use mobile banking (53%). In further places they point to the fact that their bank started to offer this service (13%) or the fact that they started to use a device providing online banking (13%) (Figure 4).

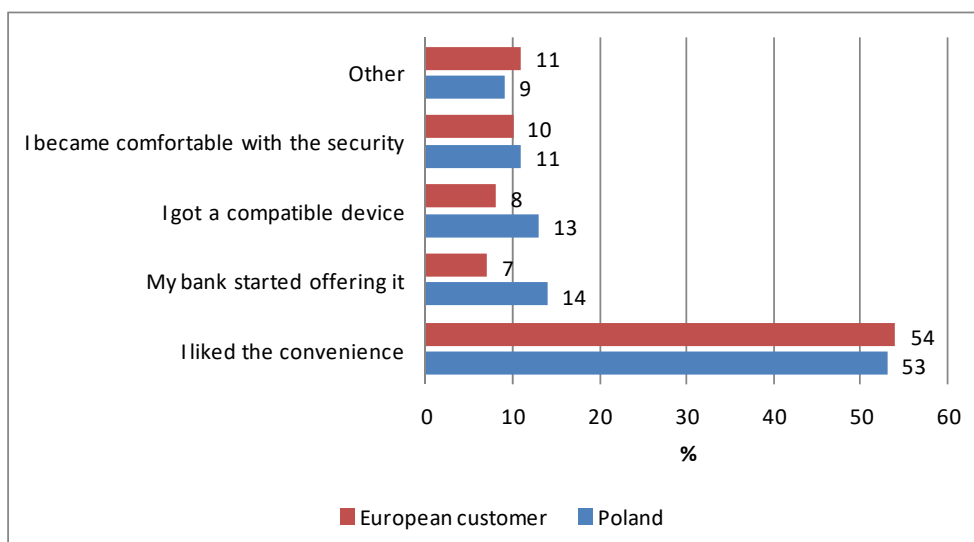


Figure 4: What was the MAIN reason you started using mobile banking when you did?

Asked to those who indicate they own a smartphone, tablet or wearable and have used it for mobile banking

Source: Own study based on: ING International Survey Mobile banking

Among the reasons for non-using mobile banking, Poles most frequently indicate the lack of confidence in security systems (54%) as well as no need to use the services (22%) or too complicated solutions (12%) (Figure 5).

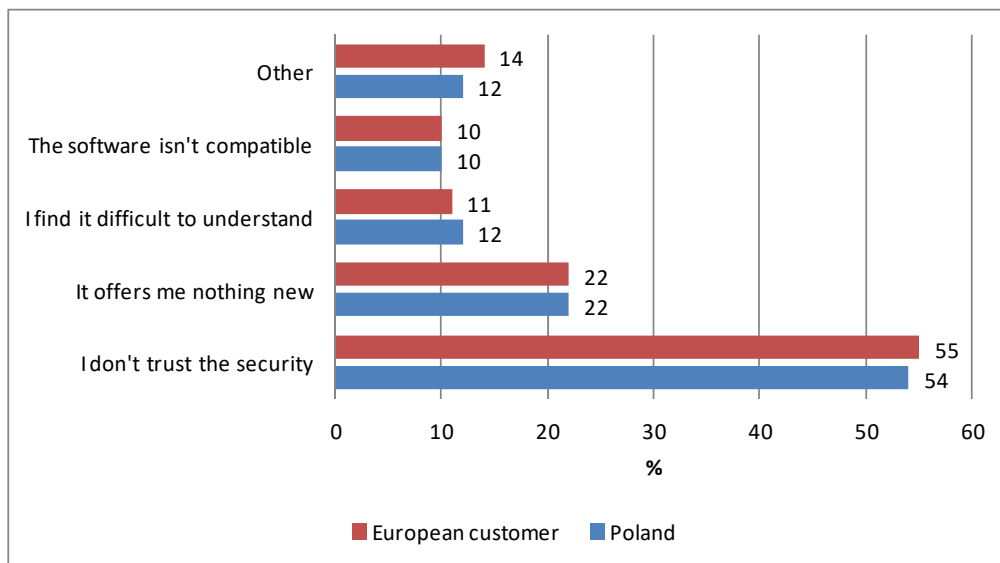


Figure 5: What are the reasons you do not use mobile banking?

Asked to those who indicate they do not use mobile banking. Multiple answers possible.

Source: Own study based on: ING International Survey Mobile banking

7 The profiles of customers using mobile banking

Quantitative and qualitative studies conducted within the research project BANK.JEST.MOBI 2016 allowed to classify the profiles of studied respondents using mobile banking into 4 groups (<http://jestem.mobi/2017>). “Enthusiasts” are people constituting 13% of the population using mobile banking in Poland. They are typical early adopters of new products and services, highly interested in technological novelties. For them, mobile banking is not an additional, but fully-fledged channel of contact with bank. Mobile banking is one of the most crucial elements enhancing their relationships with bank. On the other hand, the “demanding ones” constitute 28% of people using mobile banking in Poland. They approach mobile solutions as complementing electronic banking and they continuously compare them. They tend to “discover” weaknesses of mobile applications and they look at them in quite a critical way. “Pragmatists” are a group constituting 41% of people using mobile banking in Poland. For them it is an additional, yet important channel of contact with bank. They use core functions that facilitate everyday life. They do not fully use the opportunities of mobile banking – they are probably the people who log in with a password instead of using offered simplifications. The “reserved ones” constitute nearly 19% people using mobile banking in Poland. They adopt the least enthusiastic attitudes towards mobile and electronic banking. They rarely use mobile banking, and they use applications in rather an elementary scope. Reducing caution towards mobile banking needs the longest time in their case. Taking this group into consideration, the banks should focus on maximum simplicity and availability.

According to research conducted by Deloitte in December 2017, in Poland the rate of customers who do not use internet and mobile banking reaches 20%, i.e. 5.2 million people.

In Central Europe, the number reaches over 11 million³. These customers can be called the hostages of bank branches because they are people who use banking services via traditional channels, but they think about becoming users of internet and mobile banking. At the same time, they are prevented from changes by the conviction that implementing a different way of using banking services will be time-consuming and complicated. Another argument hampering change is the concern that digital channels will not satisfy all expectations associated with functionality and positive experience of the user (www.bankier.pl/wiadomosc/Deloitte-w-Polsce).

Appropriate use of the possibilities offered by the new EU directive concerning payment services (PSD2) provides the banks with the opportunity to gain new customers. It should support the growth of competition on the market of payment services, contribute to consolidation of a uniform market of these services on the level of EU, and strengthen customers' protection. Thanks to new regulations, the entities offering innovative solutions will be able to establish direct relationships with customers even if they have the main account in another banking institution. At the same time, "PSD2: Voice of the Consumer" research shows that takeover of customers will not be easy because 43% of the respondents declared that they would have felt discomfort in the situation of sharing information about their account with institutions other than their current bank. The respondents would share the information about their account most eagerly with banks (26%), payment agents (23%) and media suppliers (23%).

8 Practical implications and conclusions

The scope of use of mobile applications by polish retail banks in the process of shaping the offer, its communication is developing very dynamically. This process depend of allow for customers needs and its expectations. Retail banks should know customers preferences and attitudes for innovations like mobile apps. This necessary for shape competitive strategies of influencing the customers. Very important are aspects such as the lack of security, lack of trust in the system, lack of differentiation between banks offers or impersonal treatment. This could be reasons reluctance from many customers to use mobile apps.

These findings provide guidance for the maintenance and development of the current direction of the banking sector development and create marketing strategies of influencing the customers. This could be an important managerial impulse for improving consumer satisfaction. For example indication direction of retail banks activity for communicate the value of the mobile apps based on the main attributes attractive for customers and on future functional and psychosocial benefits. In addition it is be interesting that the apps allow the customization based on user profile and on its requirements, and focusing the effort in actions of CRM (Customer Relationship Management) and cross selling.

³ The research was conducted on the sample of a thousand bank customers from each country (Bulgaria, Czech Republic, Hungary, Poland, Romania and Slovakia). It was performed with the use of CAVI method in November – December 2017. According to the study, in Central Europe Internet and mobile banking services are most willingly used by Czech customers. In this respect, Poles, Slovaks and Hungarians are slightly less advanced. On the other hand, bank customers from Romania and Bulgaria are the most attached to bank branches.

With popularisation of access to bank accounts through Internet, first the way of communication between customers and bank changed. Personal computer used to be the best for that, however, over the last few years mobile telephony developed so much that its use for this purpose became almost obvious. Therefore, electronic banking enabled the customers to perform banking operations at any time, whereas mobile banking that is perceived as deriving from it, allowed for conducting them at any place. Thus, we can approach mobile banking as a natural trend of development of entire banking.

Digitalisation of financial services is an obvious trend of development for banks which results from social changes, including universal access to the Internet, high dynamics of sale of smartphones or tablets and certainly fast adaptation of innovative technologies by consumers. Thanks to dynamic progress in the sphere of innovative technologies, banks carefully follow expectations of customers who search for intuitive applications that allow to perform a lot of financial operations. It can be expected that mobile banking is going to be increasingly more adjusted to the context of use, fully personalised, accessed via occurring latest devices from the circle of the so-called Internet of Things (such as smartwatches, vehicles or TV sets) and equipped with biometric sensors and voice communication.

References

- Bankowość mobilna (2015). red. Cicharska M., Texter Wydawnictwa Naukowe.
- Barnes, S. J. and Corbitt, B. (2003). Mobile banking: Concept and potential, "International Journal of Mobile Communications", Vol. 1, No. 3.
- Borcuch A. (2016). Rozwój rynku płatności mobilnych w Polsce. Perspektywa konsumentów, dostawców i akceptantów płatności mobilnych, CeDeWu, Warszawa.
- ChauShen Chen, (2013). Perceived risk, usage frequency of mobile banking services, "Managing Service Quality: An International Journal", Vol. 23 Issue: 5
- Komisja Nadzoru Finansowego (2013). Elektroniczne metody płatności. Istota, rozwój, prognozy.- Poradnik klienta usług finansowych, Warszawa.
- Laukkanen T, Cruz P. (2008). Barriers to Mobile Banking Adoption. A Cross-national Study, Ice-B 2008 International Conferene on e-Business Proceedings, Porto.
- Laukkanen T, Kivaniemi V. (2010). The role of information in Mobile Banking Resistance, "International Journal of Bank Marketing", vol. 28 (5).
- Laukkanen, T., Lauronen, J. (2005). Consumer value creation in mobile banking services, "International Journal of Mobile Communications", Vol. 3, No. 4.
- Luarn, P., Lin, H. H. (2005). Toward an understanding of the behavioral intention to use mobile banking, "Computers in Human Behavior", Vol. 21, No. 6.
- Nielsen J., Budiu R. (2013). Funkcjonalność aplikacji mobilnych, Helion, Gliwice.
- Riivari, J. (2005). Mobile banking: A powerful new marketing and CRM tool for financial services companies all over Europe, "Journal of Financial Services Marketing" Vol. 10, 1 11–20,
- Shaikh A. A., Karjaluohto H. (2015). Mobile banking adoption: A literature review, "Telematics and Informatics" Vol. 32, Issue 1
- Tiwari R., Buse S. and Herstatt C. (2007). Mobile Services in Banking Sector: The Role of Innovative Business Solutions in Generating Competitive Advantage, "Technology and Innovation Managment" Working Paper No. 48.

Bankowość mobilna 2014 <https://www.money.pl/raport-o-bankowosci-mobilnej/bankowosc;mobilna;w;polsce,79,2,1521743.html> [access 10.06.2018]

Digital, mobile i social media 2018 (Poland); <https://mobirank.pl/2018/02/02/mobile-i-digital-w-2018-roku-w-polsce-i-na-swiecie/> [access 10.06.2018]

<http://jestem.mobi/2017/01/bankowosc-mobilna-2-0-czyli-jak-w-2017-roku-rozwijac-ten-kanal-kontaktu-z-klientami/> [access 10.06.2018]

<http://www.mobiletrends.pl/8-polskich-bankow-wyroznionych-mobilnosc/> [access 10.06.2018]

<https://www.bankier.pl/wiadomosc/Deloitte-w-Polsce-5-2-mln-klientow-nie-korzysta-z-bankowosci-internetowej-i-mobilnej-4064581.html> [access 10.06.2018]

ING International Survey Mobile banking – the next generation May 2017

PRNews.pl <https://prnews.pl/raport-prnews-pl-liczba-klientow-mobile-only-iv-kw-2017-433554> [access 10.06.2018]

Raport Polska_jest_mobi_2018, Kantar TNS.

Comparative Analysis of Factors Affecting Efficiency of Crowdfunding Projects: Boomstarter and Kickstarter

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Abstract: Crowdfunding platforms develop as a valuable business model in sharing economy. Through intensive market development, a question arises: what it takes for a crowdfunding project to succeed. This paper aims to identify the features of crowdfunding projects influencing the outcome. The country-of-origin effect is taken into account to compare the outcomes in Russian crowdfunding platform and the worldwide known Kickstarter platform. Machine learning methods are applied to primary data regarding projects on these two platforms to determine and to compare the influence of factors. The results show that there is a difference in strength of factors' influence on the Russian platform as compared to Kickstarter.

Keywords: crowdfunding, machine learning, success factors, Kickstarter, Boomstarter

1 Introduction

Online crowdfunding platforms are a typical business model in the sharing economy. Crowdfunding is a model of fundraising aimed at authors or projects which are unable to use traditional sources of funding. This phenomenon also provides community with a voice through an ability to co-finance promising projects, making both parties interested in a successful outcome (Gedda, Nilsson, S  th  n, & S  ilen, 2016; Reddy & Tan, 2017).

Crowdfunding as a field of the study received a certain degree of attention from the researchers in the last decade (Kartemo, 2017). Though there are some projects devoted to the exploration of success factors in crowdfunding projects, there is still no certainty regarding what prompts people to invest in particular projects. Thus, an opportunity to predict whether a project will succeed or not is relevant for both creators and backers (those, who fund the project). It minimises time costs and efforts for creator, and saves the backers from disadvantageous investments and disappointment. Country of origin effect was also rarely taken into account in these studies. To occupy the following research niche, the goal of this article is stated as follows: using quantitative research design, we explore the reasons behind success or failure of projects on reward-based online crowdfunding platforms by determining the influence of different characteristics of a project and comparing those among Russian and international platforms.

By exploring these relationships, we contribute to both the academic subject domain and crowdfunding practitioners. Regarding the former, the article fills research mentioned above

gap by providing unique quantitative and comparative research on success factors for crowdfunding projects. Concerning practitioners, the research results provide the insights into the difference in success factors for those interested either in starting crowdfunding campaign or in running the online platform for projects.

Following a previously stated goal, the following research question is proposed and examined: What is the difference between success and failure factors of projects on Russian and international crowdfunding platforms?

2 Literature review

Mollick (2014, p.2) claimed: "...A broad definition of crowdfunding is therefore elusive, especially as crowdfunding covers so many current (and likely future) uses across many disciplines". Overall, there can be found at least 36 definitions from 28 distinct articles which were published between 2006 and 2011, all containing different descriptions of individuals who form the crowd, their aims, type of return they receive for their investment, involved processes and, most important for this work - the Internet usage (Estellés-Arolas & González-Ladrón-de-Guevara, 2012). Unification of the crowdfunding definition is beyond the scope of this work. Therefore, we use the following academic definition of crowdfunding as a basis for further analysis. "...An open call, essentially through the Internet, for the provision of financial resources either in the form of donations or exchange for some form of reward and/or voting rights to support initiatives for specific purposes" (Macht & Weatherston, 2014, p. 3). "Founders" refers to all individuals raising crowdfunding for a cultural, social, or for-profit venture. The latter type, also known as "backers" are people who support the ideas they like by funding the project.

2.2 Classification of crowdfunding models

Three primary criteria ought to be taken into consideration to distinguish the models of crowdfunding. These are platform specialisation, funding mechanism and value proposition (Gierczak, Bretschneider, Haas, Blohm, & Leimeister, 2016, p. 12).

Regarding specialisation, crowdfunding platforms aim to meet the heterogeneous needs and requirements of projects' initiators and backers (Gierczak et al., 2016, p. 12). Many classifications for platforms' specialisation exist, although the main typology commonly used is based on backers' and initiators' goals (Zohrabyan, Fernandes, Lopes, & García, 2017) as well as their mutual responsibilities.

The second classification criterion is the funding mechanism. In contrast to traditional financial intermediaries, crowdfunding platforms do not borrow, pool, and lend money to their account. They focus on matching the projects' initiators and backers by providing information about the projects and functionalities, e.g. for reducing the risks of the investment (Méric, Maque, & Brabet, 2016). Therefore, there are various distinctive mechanisms provided by crowdfunding intermediaries. The most important mechanisms are "All-or-Nothing" and "Keep-it-All" models (Cumming, Leboeuf, & Schwienbacher, 2014; Gierczak et al., 2016).

— "All-or-nothing". Project initiators are paid out the collected amount only in case of reaching their predefined funding goal. This mechanism is based on the assumption

that founders can accomplish their goal and deliver the promised returns when they have the complete resources required for doing so (Gierczak et al., 2016).

— “Keep-it-All”. Project initiators receive any collected sum (Gerber, Hui, & Kuo, 2012). This funding model is mainly used for charitable projects or projects that use crowdfunding as a secondary source of funding (Gierczak et al., 2016).

The last classification criterion is the value proposition (Gierczak et al., 2016). It can be observed that crowdfunding and, subsequently, crowdfunding platforms may differ on multiple dimensions. To avoid inconsistencies, the typology proposed by J. Méric et al. (2016) will be used as a basis for further analysis (Figure 2). This paper dwells on reward-based all-or-nothing platforms, the representatives of which are Kickstarter and Boomstarter.

Crowdfunding Category	Mechanism	Explanation
Donation-based model	Donation	Funds are raised for non-profit organizations, for example, platforms for charity organizations
Reward-based model	All or nothing	If the targeted funds are raised, funds are transferred to project founder, otherwise the transaction is cancelled
	Take it all	The project founder will receive the raised funds, even if the amount is inferior to the displayed objective for the full project
Lending-based model	Peer-to-peer	Peer to peer collected loans providing interest or no interest at all
	Micro-lending	Micro-credit
Equity-based model	Cooperative model	Cooperative investment organization in exchange for an equity stake
	Club model	Equivalent to a private ‘investment club’

Figure 2: Crowdfunding platforms classification (Méric et al., 2016)

2.3 Success factors in crowdfunding projects

Some papers are investigating the relationship between the performance of the Internet-based crowdfunding campaigns and a set of different factors (Kaartemo, 2017). In most of the cases, authors explored success factors for the hedonistic reward-based type of platforms. The first subgroup of papers analysed success factors applying various statistical analysis methods, machine learning algorithms and text analysis. The second subgroup ran the comparative analysis and aimed to shed light on regional differences in the significance of particular success factors of the projects.

We start with an overview of the first subgroup of articles. Different researchers applied various tools and methods to analyse the features of campaigns, backers, founders and crowdfunding platforms. Majority of studies used quantitative methods to assess the projects from a single crowdfunding platform (Kaartemo, 2017). Some articles, on the contrary, limit the data to the analysis of only a particular type of projects (for instance, only Technology-related startups (Cordova, Dolci, & Gianfrate, 2015). On the one hand, such strategy allows receiving a more precise understanding of crowdfunding phenomena on a small scale. On the

other hand, data-related limitations do not allow to draw robust general conclusions on the subject (Kartemo, 2017; Short, Ketchen, McKenny, Allison, & Ireland, 2017).

There is a set of research articles devoted to the exploration of success indicators. Previous research (Kaur & Gera, 2017; Mollick, 2014; Por et al., 2016) generally highlighted the importance of some factors listed in table 1.

Table 1: Success factors for crowdfunding projects

Variable(s)	Influence on project's success on Kickstarter
Founder's experience	Highly positive
Number of rewards; Number of comments; Number of updates; Social network (Twitter & Facebook) activity	Positive
Staff pick	Weak positive
Campaign goal; Project duration.	Negative
Description length	Weak negative

Many articles investigated the connection between the success of projects and specific features of a project. The term "home bias" has been used to describe the backers' preference either to fund projects located in the same geographical area (Lin & Viswanathan, 2016) or to respond in different patterns to local and distant campaigns. Social capital and personal networks of the team are found to positively affect the chances of projects' success (Mollick, 2014). A greater number of reward levels is suggested to correlate positively with crowdfunding projects' result (Mollick & Nanda, 2016), although the number should not exceed specified levels because meaningless rewards contribute nothing to the campaign (Chen, Thomas, & Kohli, 2016). The latter study also highlighted the role of product or aim type in determining success, proposing that some categories be NIL in general more successful than the others. It is important to notice that while all studies cited above worked with data from Kickstarter or other reward-based platforms.

The last subgroup of articles covered comparative studies. This group is significantly smaller than the others (Kartemo, 2017). Frequently, such studies compare the difference in impact on success, which happened due to the country of origin feature. For instance, Zheng et al. (2014) found a positive connection between campaign duration and success for China-based projects. They highlighted that the same trend could not be observed in the US dataset. Cho & Kim (2017) proposed the difference in behaviour of South Korean project creators and their Kickstarter-based counterparts, suggesting that the former group would rarely post updates, offer fewer reward tiers. During the literature review and search for relevant articles through scientific citation indexing services (Scopus & Web of Science), none of the works seemed to compare data from Russian crowdfunding platforms, such as Planeta.ru or Boomstarter, although (Torkanovskiy, 2016) had compared business models of aforementioned platforms and their Western counterparts.

To sum up, the lack of existing quantitative comparative articles regarding leading Russian crowdfunding platforms is the gap in the scientific knowledge this research is aimed to occupy. To coherently fill in the gap, the following methodology was designed.

3 Methodology

The primary data gathering method and tools were the same for both datasets. To semi-automatically collect data on relevant projects we used web scraper. This algorithm is capable of extracting specific information from web pages - on Boomstarter and Kickstarter official sites. Similar methods have been used in other works in this field. To gather a dataset regarding projects listed on Boomstarter, the algorithm has searched for all projects - both current and finished, harvesting information from projects' and authors' pages. Kickstarter, unlike its Russian counterpart, conceals unsuccessfully ended crowdfunding campaigns from web search engines or the website's search option. Thus, a secondary data was used to create a list of hyperlinks for 176,777 projects listed on the platform from 2012 till 15/02/2018 (out of 397,370 projects ever launched as of 08/04/2018). This list of projects was the sampling frame of the study. We used a stratified sampling method to collect data by web scraper.

The primary tool used during the data gathering possess abysmal chances of the mistake as the whole process is automated and requires only initial settings from the researcher. The sampling frame for Kickstarter provides certain limitations. While it seems to be the largest publicly available repository of information regarding platform's projects, still slightly less than a half of population could be accessed due to certain technical limitations of web scraping technologies and restraints set by Kickstarter. Awhile for Boomstarter facing similar restrictions approximately 70 per cent of project population was collected. Nonetheless, sample frame contained information regarding all existing types of projects regarding goals, categories, outcomes and other relevant characteristics for both past and currents campaigns.

3.1 Limitations

The primary limitation of methodology and design, in general, comes from the object of analysis and, consequently, the data. While Boomstarter sample reliability is rather indisputable, it is essential to understand that the platform cannot be considered representative for the Russian online crowdfunding in general. Including data regarding projects on the second major platform (Torkanovskiy, 2016) - Planeta.ru - would resolve this issue. Alas, the latter platform is more complicated regarding access to data and operates on mixed funding principles, greatly sophisticating the comparative analysis and limiting the validity of possible findings.

Furthermore, another external validity threat can be linked to the changing nature of crowdfunding platforms. One must consider the possibility of new options or trends emerging on the platforms. For instance, as of March 2018 Kickstarter introduced "a pledge without a reward", which occurred while the research was already being conducted. Thus, the results of this study might lose relevance as time goes on, yet it is troublesome to forecast the exact period of applicability.

Finally, a particular possibility of external explanations does exist as this study does not go into detailed analysis of different project categories on analysed platforms, which might have different trends and patterns as they at least have varying success rate according to Kickstarter's statistics. Moreover, some of the previous research in this field concentrated on more specific and hard-to-obtain characteristics or implied other methods. Nonetheless, the variables and methods chosen in this study are based on the papers done in the similar design (see Zheng et al., 2014) and should be valid for similar purposes. Regarding other internal threats, owing to chosen selection, the research avoids many of validity traps such as selection

bias (solved by proper sample construction), test effect (cross-validation is used to prevent overfitting), the effect of statistical regression (datasets are to be preprocessed and scaled). The remaining, e.g. historical effect, will be taken into account while discussing the results.

3.2 Samples

The Boomstarter dataset features 7139 observations. The sample should be relatively close to the population, or at least contains the most substantial sampling frame possible. The sample includes projects concluded throughout platform's whole period of activity - from September 2012 till March 2018 (the platform began operating in August 2012). Significantly, due to specifics of Boomstarter's website, it is impossible to obtain information about project's duration, which, as was mentioned in the literature review, is considered to be significant. Specific features also include the presence of curators - third-parties supporting the project by different means. While the platform is created for crowdfunding in Russia, specific projects come from abroad.

The data distribution is biased among many variables, including the goal, pledged sum, number of backers, updates, comments, author's experience and others (Table 2). 16.4% of all projects attracted 0 investment; many other characteristics tend to take values close to 0 as well. Only 1147 out of 7139 projects (16.07%) are successful.

The Kickstarter dataset consists of 7942 observations. The sample includes projects concluded between years 2011 and 2018. Similar to Boomstarter, the data distribution is biased among different variables. 2959 projects out of 7998 observations were successfully funded (37.04%). So, the Kickstarter sample has a higher rate of success.

Table 2: List of variables in Boomstarter and Kickstarter dataset

Variable	Description	Boomstarter	Kickstarter
Title	Title of the project	X	X
Description	Description of the project	X	X
Location	Country & city where the project is based	X	X
Pledged	Total pledged sum	X	X
Goal	The target sum	X (in rubles)	X (in \$ USD)
Category	The category of the project	X	X
Backers_n	Number of backers	X	X
Updates_n	Number of updates the project page has received	X	X
Comments_n	Number of comments the project has received on the platform	X	X
Fb_n	Number of "shares" the project has received on Facebook	X	X
Vk_n	Number of "shares" the project has received on Vkontakte	X	-
Fb_friends	Number of author's friends on Facebook	-	X
Status	The outcome of the project	X	X
Author_projects	Number of projects the author has created	X	X
Author_sponsor	Number of projects the author has backed	X	X
Curator_sponsor	Whether the project has a curator or not	X	-
Has_video	Whether the project has a video or not	X	X
Days_full	Project duration in days	-	X
faq	Number of FAQ items	-	X

3.3 Data processing and analysis

In both datasets, some of the variables have a high range of values: the majority of values equal zero with dramatic deviations for a relatively small fraction of projects. Therefore, feature scaling was applied to all numeric variables to ensure thoughtful analysis and software efficiency.

For predictive models, some methods were tried. Logistic regression as well as Support Vector Machine (with polynomial and radial kernels) had insufficient prediction quality, while k-nearest-neighbours algorithm performed better but ultimately failed to reasonably predict successful projects. Random Forest algorithm was selected as the final method for all predictive models as it had both highest accuracy and Specificity/Sensitivity ratings. Due to Boomstarter dataset being extremely unbalanced with 16% success rate, models were trained using all successful projects and an equal amount of randomly selected unsuccessful counterparts. While this has worsened models' ability to correctly identify unsuccessful projects by approximately 10%, more than a two-fold increase incorrectly predicted successful projects made the trade-off worthy. The same was done with Kickstarter datasets and models.

To check the predictive power of ML models, accuracy, specificity and sensitivity were used. The factor importance is measured via the mean decrease in accuracy of a model after the variable is excluded, along with its influence on accuracy within a class. Combined with k-fold cross-validation, said methods should significantly decrease chances of overfitting and improve the bias-variance tradeoff of our models when accessing the predictive power.

Finally, to further compare the difference in the influence of project's characteristics on different platforms, a cross-test is conducted. Models trained on Kickstarter's 50:50 sample described above were used to predict the outcome of all campaigns on Boomstarter, and vice-versa. All shared variables were used, while categories were grouped and renamed similarly. A variable "social" was mutated from combined number of shares on Facebook and Vkontakte for Boomstarter and the number of Facebook friends for Kickstarter. Differences in currency and goal distribution between platforms do not possess significant issues as the data was scaled.

4 Results

The original Boomstarter sample contained observations of 7139 projects with the relatively low overall success rate (16%). For analysis, all projects with goal above 2500000 rubles were filtered out as none of them were successful. The final sample contained 7028 observations.

Regarding goal, the distribution of success and failure among different target sum levels may also be considered biased as the mean score of goal exceeds 3rd Quartile. Half of all projects requests 130 000 rubles or less and has the higher concentration of completed campaigns - 21%, whereas another half steadily elongating to maximum goal levels has lower success rate - 11%, continually decreasing as the sum goes up. (Figure 3)

While Boomstarter describes itself as a "Russian crowdfunding platform", it has a high variety of projects' locations - 488 cities from 52 countries. Notwithstanding, abroad-oriented campaigns contributed only 3.29% of the total number, sharing success rate with their Russian counterpart with marginal deviation from mean level. Russia-based projects are distributed

unevenly among 374 cities with 246 of them hosting no more than a single project, while top five cities by the number of projects contributed 55.88% of all campaigns on the platform (see Table 3).

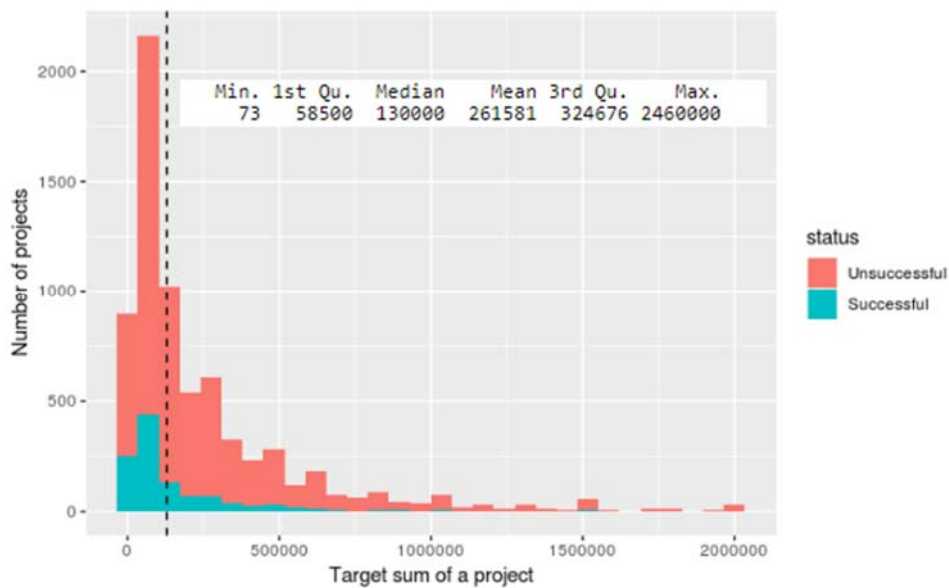


Figure 3: Distribution of target sum among campaigns on Boomstarter

Similar to international project distribution, the case of curated campaigns also demonstrates dramatic bias (4% of all projects are supported). Despite this, the success rate among curated is three times higher than among independent - 49% and 15% respectively. Similar remarkable difference between success and failure indexes might be observed among projects of experienced and new-comer authors. Being biased, the distribution, however, depicts noticeable deviation from average success rate for both groups.

Table 3: Five most common project locations on Boomstarter

Location	Number of projects
Moscow	2628
Saint Petersburg	867
Yekaterinburg	190
Novosibirsk	143
Chelyabinsk	99

The same applies to video materials, as projects with and without a video contribute approximately equal parts of the dataset – 49% and 51% correspondingly (Figure 3). Campaigns with video support tend to have the higher ratio of successfully finished projects (22.5% as opposed to 10.35%). Finally, the success rate varies among different project categories. Boomstarter separates all projects into 22 main categories with 68 subcategories and a couple of unique, time-limited categories.

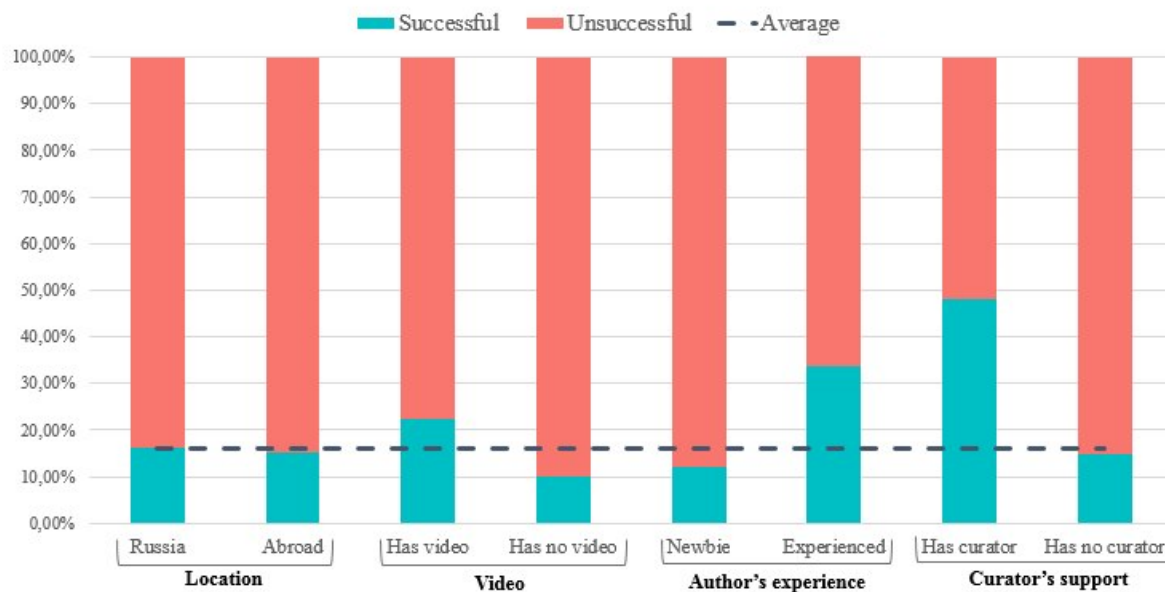


Figure 3: Distribution of success and failure among some binary features on Boomstarter

4.2 Models

Apart from applying different methods of ML mentioned in the methodology, different sets of variables were tested during construction of final Random Forest models.

Using all variables available by the end of a crowdfunding campaign, except for the pledged sum, the model achieved excellent prediction quality: 0.91 Accuracy, 0.9 Sensitivity, 0.93 Specificity on the Boomstarter dataset. However, such model would not strictly fit proposed research design and answer the research question as the number of backers, comments, and social media shares may be interdependent with project's success. Furthermore, these variables all had immense explanatory power, thus not allowing to assess the importance of primary variables which were of interest to this study. It can be stated, however, that attracting a crowd of engaged supporters and communicating with them through updated quite expectedly was a feature of those who succeeded, with few exceptions.

Instead, the final models were constructed using only initial parameters chosen by the author at the beginning of a crowdfunding campaign. The "50:50" samples described in methodology were used for training.

The final models were constructed using only initial parameters chosen by the author at the beginning of a crowdfunding campaign. Such actions dramatically decreased the ability of algorithms to predict successful projects as the dataset has a decent bias towards the unsuccessful ones. Consequently, the chosen samples were implemented for final training of the models. The results are drowned from applying created models at full dataset.

4.2.1 Boomstarter model

The final model for Boomstarter dataset correctly predicted 4513 out of 5881 unsuccessful and 843 out of 1147 successful projects. Thus, the quality characteristics are as follows: Accuracy – 0.7621, Sensitivity – 0.7674, Specificity – 0.735 with unsuccessful projects being

the “positive” class. The model highlighted all variables apart from some categories as useful for making predictions. Coupled with high accuracy, this reconfirms that initial parameters are essential for campaign's success.

In addition to the models and variable importance for prediction, Spearman's rank correlation coefficient was calculated to measure the correlation strength between project outcome and independent variables.

Combining results from correlation matrix and variable importance measure from the model, the following conclusions can be drawn. Previous experiences of an author possibly play the most prominent role in determining whether a project will be successful, scoring 0.342 for backing experience on the platform and 0.276 for total created projects. Presence of a video on the starting page of a project can positively influence (0.205) the likelihood of a project becoming funded. As could have been anticipated, the effect of the requested sum shows a different pattern (-0.2), i.e. the more prominent the needed sum, the lesser are the chances a project being successfully funded. Described results show minor discrepancies regarding the strength of influence if compared to model's variable importance rankings. However, the pattern is similar enough to conclude influence of factors.

4.2.2 Kickstarter model

The final model for Kickstarter dataset correctly predicted 4011 out of 5028 unsuccessful and 2394 out of 2914 successful projects. Thus, the quality characteristics are as follows: Accuracy – 80.65%, Sensitivity – 0.7977, Specificity – 0.8216 with unsuccessful being the “positive” class.

Correlation matrix for Kickstarter data showed patterns similar to findings of previous research regarding the direction of factors' influence. Results regarding project's goal, duration, the presence of video, founder's experience and the number of FAQ items are analogous. Other authors proposed weak negative impact of project's description length, while this study's data proposes weak positive relation. This is most likely due to sample's features as the connection is deemed weak in both cases. Overall, the results of the analysis are in line with previous findings.

4.3 Comparison of factors' influence

Several results may be drawn from the comparison of factors' influence within final models for platforms. The first important notion is the similarity in positiveness or negativeness of the impact that initial project parameters have on the outcome of the campaign. In both cases, all variables apart from campaign goal positively affect the chances of success. The only difference could arise from the impact of description length. For Boomstarter, it has a minor positive effect; for Kickstarter, the influence is considered to be weak negative by other papers and weak positive by the findings of this study.

The second aspect of consideration is the strength of influence as measured by the relative difference in predictive power within models and correlation strength. Here the difference between Russian platform and Kickstarter is more evident. Author's previous experience has a stronger impact on Boomstarter, while their engagement with other projects through backing is more critical on Kickstarter. Impact of project's page having a video is higher on Kickstarter as demonstrated by both correlation analysis and models' variable importance measures. Furthermore, the goal was slightly more critical on the Kickstarter, although the difference is weak & sampling limitations should be considered.

4.4 Cross-test

For cross-test, models with all similar variables were constructed using a full dataset of another platform instead of the test sample. It appeared that the model trained on Kickstarter data (scored 87.21% accuracy) was not able to determine the successful projects on Boomstarter (23.45% correct), though it could determine the unsuccessful ones exceptionally well (99.64% correct). At the same time, the model based on Russian platform's data was far more precise (84.54% accuracy). While successful projects were sometimes misjudged (79.79% correct), the ratio of correctly predicted unsuccessful projects was high (92.72%). Such results are inferior compared to quality measures received from applying same models onto original data. This, along with the low ratio of correctly determined successful Boomstarter projects, may be explained by two reasons. Firstly, there is indeed the difference in variable's impact on project success as was shown in comparison, even if it is not profound. Secondly, there may be structural differences in data which were not fully resolved through scaling, i.e. different distribution.

5 Discussion and conclusion

When setting up a project on Boomstarter, one must actively consider what they want to convey to the crowd and how it aligns with author's needs. All initial parameters of a campaign proved to be influential and allow to differentiate between future successes and failures rather precisely. Many projects ran by the author, their support of other campaigns on the platform, curatorship, presence of video and description length all in general positively affect chances of being funded, with various levels of influence. A high target sum, on the other hand, could severely hold back a project, with success rate steadily deteriorating after 130 000 rubbles mark (approximately 2250 USD). Categories have mixed influence, though it is worth noting that they are vaguely defined and composed of a multitude of subcategories.

In general, this means that those who wish to start funding their ideas through Boomstarter shall try to be active on the platform through backing others, find a curator to attract more traffic, and choose the right idea. Music groups and game developers are more successful than innovative entrepreneurs are. Aiming for large sums is also risky, though quite a few projects managed to gather sums 20 times higher than the mean goal on the platform. The inclusion of a video and detailed description of one's idea also may result in a more successful campaign.

The influence of factors mentioned above indeed differs from that of same characteristics on Kickstarter. There is no variation in the direction of relations apart from the probable positive effect of description length on Boomstarter as opposed to negative on Kickstarter. However, the strength of influence does differ notably as the presence or lack of a video and number of projects backed by an author are slightly more critical on Kickstarter, while author's experience is more influential on Boomstarter. Interestingly, the goal had the comparable strength of influence on both platforms.

There are certain limitations to the results of this study. The reliability of Boomstarter sample and resulting analysis is high, while the validity of Kickstarter analysis and thus comparison was ensured through benchmarking of findings against previous research with no significant deviations to be found. However, all conclusions are based on general trends observed within both platforms and do not necessarily reflect reality among some instances or groups of

projects on both platforms. Furthermore, results of comparison have to be brought to the national level with caution as other Russian crowdfunding platforms exist. Relative influence of factors may deviate slightly if more in-depth analysis with more variables is to be performed.

To resolve issues mentioned above, a few future directions of research can be proposed. First of all, in-depth analysis on lower levels, such as categories of projects, can be conducted to draw robust conclusions for specific groups of campaigns. This could be done in both, comparative or non-comparative design. Secondly, analysis and comparison of Planeta.ru - the second major Russian crowdfunding platform (Torkanovskiy, 2016) - to Boomstarter and international platform(s) would allow setting clear the differences on the national level. As of now, conclusions of this study should be extended to said level with caution.

References

- Chen, S., Thomas, S., & Kohli, C. (2016). What Really Makes a Promotional Campaign Succeed on a Crowdfunding Platform? *Journal of Advertising Research*, 56(1), 81–94
- Cho, M., & Kim, G. (2017). A cross-cultural comparative analysis of crowdfunding projects in the United States and South Korea. *Computers in Human Behavior*, 72, 312–320.
- Cordova, A., Dolci, J., & Gianfrate, G. (2015). The Determinants of Crowdfunding Success: Evidence from Technology Projects. *Procedia - Social and Behavioral Sciences*, 181, 115–124.
- Cumming, D. J., Leboeuf, G., & Schwienbacher, A. (2014). Crowdfunding Models: Keep-it-All vs All-or-Nothing. *SSRN Electronic Journal*, 41.
- Estellés-Arolas, E., & González-Ladrón-de-Guevara, F. (2012). Towards an integrated crowdsourcing definition. *Journal of Information Science*, 38(2), 189–200.
- Gedda, D., Nilsson, B., Sâthén, Z., & Sjøilen, K. S. (2016). Crowdfunding : Finding the Optimal Platform for Funders and Entrepreneurs. *Technology Innovation Management Review*, 6(3), 31–40.
- Gerber, E. M., Hui, J. S., & Kuo, P.-Y. (2012). Crowdfunding: Why People Are Motivated to Post and Fund Projects on Crowdfunding Platforms. In *Proceedings of the International Workshop on Design, Influence, and Social Technologies: Techniques, Impacts and Ethics (Vol. 2, No. 11)* (p. 10).
- Gierczak, M. M., Bretschneider, U., Haas, P., Blohm, I., & Leimeister, J. M. (2016). Crowdfunding: Outlining the New Era of Fundraising (pp. 7–23). Springer, Cham.
- Kaartemo, V. (2017). The Elements of a Successful Crowdfunding Campaign: A Systematic Literature Review of Crowdfunding Performance. *International Review of Entrepreneurship*, 15(3).
- Kaur, H., & Gera, J. (2017). Effect of Social Media Connectivity on Success of Crowdfunding Campaigns. *Procedia Computer Science*, 122, 767–774.
- Lin, M., & Viswanathan, S. (2016). Home Bias in Online Investments: An Empirical Study of an Online Crowdfunding Market. *Management Science*, 62(5), 1393–1414.
- Macht, S. A., & Weatherston, J. (2014). The Benefits of Online Crowdfunding for Fund-Seeking Business Ventures. *Strategic Change*, 23(1–2), 1–14.
- Méric, J., Maque, I., & Brabet, J. (2016). *International Perspectives on Crowdfunding*. Emerald Group Publishing Limited.
- Mollick, E. (2014). The dynamics of crowdfunding: An exploratory study. *Journal of Business Venturing*, 29(1), 1–16.

Por, M. H., Yang, S.-B., & Kim, T. (2016). Successful crowdfunding: the effects of founder and project factors. In *Proceedings of the 18th Annual International Conference on Electronic Commerce e-Commerce in Smart connected World - ICEC '16* (pp. 1–7). New York, USA: ACM Press.

Reddy, S. K., & Tan, Y. H. (2017). Crowdfunding: Financing ventures in the digital era. *GfK Marketing Intelligence Review*, 9(1), 36-41

Short, J. C., Ketchen, D. J., McKenny, A. F., Allison, T. H., & Ireland, R. D. (2017). Research on Crowdfunding: Reviewing the (Very Recent) Past and Celebrating the Present. *Entrepreneurship Theory and Practice*, 41(2), 149–160.

Torkanovskiy, E. (2016). Non-equity Crowdfunding as a National Phenomenon in a Global Industry: The Case of Russia (pp. 115–123). Springer, Cham.

Zheng, H., Li, D., Wu, J., & Xu, Y. (2014). The role of multidimensional social capital in crowdfunding: A comparative study in China and US. *Information and Management*, 51(4), 488–496.

Zohrabyan, S., Fernandes, P. O., Lopes, R. P., & García, J. Á. (2017). Connecting Funding to Entrepreneurs: A Profile of the Main Crowdfunding Platforms (pp. 97–129). Springer, Cham.

Education and Human Resource Development

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This stream addresses topics covering a wide variety of aspects in current research and application that are relevant to education and human resource development: Relevance of HRD Theories to Practice; Transfer of Training; Corporate Social Responsibility and HRD; National HRD Research, Theory, and Practice; Values and Ethics in HRD; Quality of Work Life; HRD's Role in Community Development; HRD's Role in Social Development; HRD's Role in Economic Development; Information & Communication Technology and HRD; Workplace Learning; Social Networks in HRD; Innovative Practices of HRD; Performance and Career Development; Gender/Diversity and HRD; Global/Cross-Cultural HRD; Emerging Issues in HRD; HRD's Role in Mergers and Acquisitions; Evaluation of HRD Activities; Relationship between HRD and HRM; Preparation of Expatriates for International Assignments.

Who is an “older worker” and why? A co-workers’ perspective

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1 Introduction

In most European countries the population and the workforce are ageing and this phenomenon has been labelled the social challenge of the 21st century. The age structure of the EU population is projected to change significantly in the coming decades. The demographic old-age dependency ratio (people aged 65 or above relative to those aged 15-64) is projected to increase significantly in the EU as a whole, being about 25% in 2010, it has risen to 29.6% in 2016 and is projected to rise further, and eventually reach 51.2% in 2070 (European Commission, 2017). Portugal follow the EU trends, the number of workers aged 25-44 was 50% in 1997 and decreased to 47% in 2017. In the same period, workers aged 55-64 increased from 11,2% to 16,2% in 2017. Within this context, in order to ensure that talent and skills will be available in the near future organizations will have to implement HR policies and practices that match the needs, the expectations and the motivation of older workers, and that exploit the full potential of an aging workforce. But there is still a current lack of consensus on the term “*older worker*” and this may present a critical issue for policy makers and organizational decision makers alike (Truxillo et al, 2012). In particular HR policies need to be adjusted to an aged workforce and, therefore, how older workers are considered in organizations by managers and co-workers will have an important influence on the design and implementation of appropriated HR practices. Previous important work suggest that HR managers and supervisors decisions on identification of talent for promotion or access to training and development opportunities at work are based on the view of who constitutes an older worker (McCarthy, Heraty, Cross & Cleveland, 2014), and age discrimination in the workplace has been referred for decades and remains a consistent problem (Hirsch et al, 2000; Kite & Johnson, 1988). A first approach to who is an “*older worker*” suggest that the way employees are managed in organizations in relation to their age is likely to be determined by certain underlying general conceptualizations of ageing (Schalk et al, 2010). However, research has been focused on organizational practices discrimination to older workers and less attention has been taken to the co-workers perspective. Who they consider an “*older worker*” to be and why they consider such a worker to be “*older*”, and which attributes co-workers link to an older colleague.

This study offers an empirical investigation of the construct of age in the workplace and addresses calls for further studies at the context of the organization by trying to identify the

co-workers’ perception about “*older workers*”, a perspective yet less researched. A first contribution in this study explore at what age a worker is perceived by colleagues as “*older*”, a second contribution is to empirically explore if the identified age is the same for a male and for a female “*older worker*”. Finally this study aims to identify the attributes, or explanatory factors, that are behind the definition of an “*older worker*” based on a co-workers perspective.

Research questions:

1. At what age will co-workers in organizations define a colleague as an “older worker”?
2. Will the age of a “Male older worker” be the same of a “Female older worker”?
3. How will co-workers conceptualize an “older worker”?

2 Methodology

The study was carried out through a self-completion online questionnaire distributed by email to employees in Portuguese organizations where researchers had conducted previous studies. Based on voluntary participation, between January and February 2018, we asked participants after completing the questionnaire to send it to others employees in the organization (*snowball method*). The sample for this study consists of 360 individuals, of whom 45.3% are male and 54.7% are female. The average age is 44.7, and the range is 25 to 64 years. Because the goal of the study was to define an “*older worker*” and to explore the rationale underpinning this age two questions were asked. The first question simply asked participants to state the age (in years) at which they consider an “*older worker*” and a second question asked participants to indicate the level of agreement with each of 15 characteristics that has been previously identified in ageing at workplace literature. The questionnaire had two versions, the difference was in the formulation of the first question. Of the 360 participants in our sample, 166 of participants answered the question to indicate an age for considering a “*Male Older Worker*” for a new position in the organization, and 194 of the participants the question was to indicate an age for considering a “*Female Older Worker*”. The second question was the same in both versions of the questionnaire, all participants were asked to indicate the level of agreement with each of 15 characteristics previously identified in ageing at workplace literature (e.g. Sterns & Miklos, 1995; McEvoy & Blahna’s, 2001; CIPD, 2005; Taneva & Arnold, 2016) in order to understand the rationale underpinning the age answer.

3 Results

When asked, in the first question, to suggest an age, participants define an “*older worker*” to be aged 56 (SD=8.3). Answers related to a “*male older worker*” the age is 58 (SD=7.6), however when the question was related to a “*female older worker*” the most popular view is that is someone aged 54 (SD=8.5). The results illustrate that gender differences still persist, female workers become “*older*” at a younger age. There is a slight variation in the perception of an “*older worker*” when we break answers by age range showing that younger participants define an “*older worker*” at a younger age (Table 1.)

Table 1. Co-workers perception of an “older worker” by age range

Participants age group	“Older worker” age	SD
25-34	52,9	9,7
35-44	55,5	7,9
45-54	56,9	8,1
55-64	58,6	8,3

Results about explanatory factors, which are behind the definition of an “older worker”, show the majority of participants perceiving that capabilities, or abilities, decrease with age (Table 2).

Table 2. Perceptions that abilities increase/decrease with age

Abilities	Participants (%) Level of agreement
Increase change resistance	60,0
Decrease technological skills	56,7
Decrease career ambition	53,6
Increase learning difficulties	50,6
Decrease motivation to training	40,0
Decrease work energy	37,2
Decrease physical ability	35,0
Decrease productivity	31,4
Decrease flexibility	30,3
Decrease work absortion	24,2
Decrease work motivation	23,9
Increase absenteeism	20,0
Decrease proactive behaviour	19,7
Increase work-life conflict	19,4
Decrease work dedication	18,9

More than 50% of the participants agree that major concerns with “older workers” relies on issues as resistance to change, updating tech skills, career ambition and difficulties in learning new skills.

4 Conclusions

Data from our study, suggest not only managers and supervisors, as referred in literature, are reflecting shared beliefs about age but also colleagues, which describe someone as “older” at 56 based in terms of losing capabilities or skills and developing a lower organizational and task commitment.

Findings of this study, may be seen as a contribution to HR leaders develop strategies on how to retain and manage “older workers”. The need to retain “older workers” until their retirement (age 66.5 in Portugal by 2019) is being driven by concerns about keeping skills and knowledge, and the biggest challenge may be on how to motivate them. Further research is needed in order to understand the ageing phenomena by different occupations and sectors, and research that takes in account specific organizational policies and practices may further facilitate the understanding of this “older worker” concept and how to design and implement good human resource management practices.

References

- European Commission (2017). *The 2018 Ageing Report*. European Economy Institutional Paper 065. Brussels.
- Gonyea, J. (2009). *The Older Worker and the Changing Labor Market: New Challenges for the Workplace*. London and New York. Routledge.
- Hirsch, B.; MacPherson, D. & Hardy, M. (2000). Occupational age structure and access for older workers. *Industrial and Labor Relations Review*, 53 (3), 401-419.
- Kite, M. & Johnson B. (1988). Attitudes toward older and younger adults: a meta-analysis. *Psychology and Aging*, 3 (3), 233-244.
- McCarthy, J.; Heraty, N.; Cross, C. & Cleveland, J. (2014). Who is considered and “older worker” Extending our conceptualization of “older” from an organizational decision maker perspective. *Human Resource Management Journal*, 24 (4), 374-393.
- McEvoy, G. & Blahna, M. (2001). Engagement or disengagement? Older workers and the looming labor shortage. *Business Horizons*, 44 (5), 46-52.
- Riach, K. (2009). Managing “difference”: understanding age diversity in practice. *Human Resource Management Journal*, 19 (3), 319-335.
- Schalke, R; Van Veldhoven, R; De Lange, A.; De Witte, H.; Kraus, K.; StamoV-Roßnagel, C.; Tordera, N.; Van der Heijden, B.; Zappalà, S.; Bal, M.; Bertrand, F.; Claes, R.; Crego, A.; Dorenbosch, L.; De Jonge, J.; Desmette, D.; Gellert, F.; Hansez, I.; Iller, C.; Kooij, D.; Kuipers, B.; Linkola, P.; Van den Broeck, A.; Van der Schoot, E. & Zacher, H. (2010). Moving European research on work and ageing forward: overview and agenda. *European Journal of Work and Organizational Psychology*. 19 (1), 76-101.
- Snape, E. & Redman, T. (2003). Too old or too young? The impact of perceived age discrimination. *Human Resource Management Journal*, 13 (1), 78-89.
- Sterns, H. & Doverspike, D. (1989). Aging and the retraining and learning process in organisations, in Goldstein I. and Katzed, R. (eds.). *Training and Development in Work Organisations*, San Francisco, CA. Jossey-Bass.

A Mexican in Europe: An Autoethnographic Exploration of Personal and Professional Self-expatriation

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Abstract: Human resource development (HRD) has a long history of developing, supporting, and repatriating expatriates. McLean, Kim, and Pruetipibultham (2017) conducted a comprehensive literature review of HRD's involvement in expatriation and inpatriation, underscoring the important role that HRD plays in this process, especially in the continuing globalization of business. Most of the reviewed research focused on personnel expatriated by their employers, primarily in U.S. and U.K. companies (e.g., Chien & McLean, 2011). There are, however, examples from the literature of companies expatriating from other countries, such as Brazilians in the U.S. (Polesello & Stout, 2018). However, there is an emerging body of literature focusing on self-initiated expatriation (e.g., Ridgway & Robson, 2018). Existing studies have focused primarily on surveys (post-positivism) and interviews (phenomenology), with occasional inclusion of ethnography, as the epistemologies used in the research.

Keywords: intellectual capital, capital theory, secondary schools, educational organisations

1 Problem Statement and Research Question

This study was driven by the question: What is the experience like for a Mexican (Luz Maria Gonzalez Hernandez) who self-initiates expatriation in France? Not only does this focus on countries not included in the reviewed literature (Mexico to France), but it also provides additional insight into the experiences of self-initiated expatriation. Given the trend toward broader globalization and the experiences of self-initiated expatriation, this study fills an important gap in the literature and moves forward our understanding of HRD's roles in this process.

2 Methodology and Methods

We used autoethnography as our methodology. While this is not a new research methodology (Sambrook, 2016), it has a relatively recent application in HRD. Two recent examples of its use in HRD include Grenier (2015) and Alagaraga and Wilson (2016), both supporting the use of autoethnography in HRD research and then providing examples of such research by developing their own autoethnographic stories, the later with critical reflection included. Such an approach provides an in-depth case that invites readers to reflect on the experience

and determine the meaning of stories in their own practice. Based on the strengths of such an approach, we used autoethnography in our study.

2.1 Participant

The focus of the autoethnography was Luz Maria Gonzalez Hernandez, a 37-year-old Mexican electronics engineer currently employed as sales manager in France serving French customers for ContiTech Division of Continental AG, a German company. She graduated in 2015 with a master's in international business from IÉSEG, School of Management, in Paris. It was in an organization development course offered as part of that program where she and Gary N. McLean met. Since that meeting, they have continued to be in regular contact and have worked on another research paper together. McLean has extensive involvement in international business and expatriation research. McLean initiated the autoethnography with a list of questions and then provided critical feedback stimulating dialogue.

2.2 Autoethnographic Questions

McLean posed eleven questions for Gonzalez Hernandez to reflect on and answer in print:

1. You and I first met when I was teaching for IESEG in France. What was your reason for traveling to France from Mexico to do a master's degree?
2. What was your experience like studying for a degree in English in France?
3. When you graduated, you decided to stay in France rather than return to Mexico. Why?
4. What has been your job history?
5. You have been working across Europe. What have these experiences been like?
6. You have recently moved to a new company. Why, and what differences have you experienced?
7. As a Mexican, what have been your major work challenges?
8. What have been your major personal challenges?
9. What have you found most rewarding to you in your work experiences in Europe?
10. What have been most rewarding to you in your personal experiences in Europe?
11. Is there anything else you would like to share?

2.3 Analysis Process

Autoethnography often uses critical reflection and dialogue as a form of analysis. McLean read Gonzalez Hernandez's extensive responses (a 32-page, single-spaced transcript of more than

10,000 words) many times. Based on that reading, he asked additional questions to encourage greater reflection on the experiences by Gonzalez Hernandez and to seek clarification. Based on this dialogue, McLean identified themes with supporting quotes within two categories of personal and professional learnings of Gonzalez Hernandez's experiences as a Mexican working in France for a German company. The analysis was then shared with Gonzalez Hernandez to ensure accuracy (Were the quotes accurately quoted from the transcript?) and trustworthiness (Did the themes accurately and adequately reflect the core of her experiences?). Minor adjustments were made based on her review.

3 Findings

Based on frequent reading of the transcript, McLean identified two sets of findings: personal learnings and professional learnings. These learnings follow, supported by quotes from the transcript of the dialogue.

3.1 Personal Learnings

The personal learning themes follow, supported by brief quotes from the transcript.

Fulfillment of Early Dreams

The idea to study a Master's degree in Europe was in my mind when I was in the last year of high school.

Role of Gender in Shaping One's Future in Mexico

As I grew up, I started to do some research about potential universities within my country, in which I could pursue a Bachelor's degree in Physics. However, as this was not available in my city, it was a challenge to convince my dad to let me go somewhere else to do my studies, as I am the oldest of three daughters.

Role of Reading in Shaping Career Vision

At the age of 15, I was not yet convinced about my future career; literature was, to me, an opportunity to enter into a different world/time by reading novels.

Importance of Justice as a Value

[as a teenager considering law as a career] Personally, regarding values, justice is a very important matter...I couldn't imagine my life by thinking that I must do my best to defend someone who caused suffering of another human being.

Impact of Perfectionism

As I'm very much a perfectionist, I decided not to become a doctor, as I was afraid of skipping one page of a book that might contain the answer to save the life of a patient, so I didn't want to be responsible for getting into that type of trouble.

Broad Learning as a Child

I have always been very curious, and, as a kid, my mom continuously looked for opportunities to expose us to different areas, such as music, dance, theater, sports.

Impact of Role Models, Family, and Friends

Accounting or finance were also in my scope, but I believe this was more related to the pressure of my family by having an aunt as a very successful accountant in our city, and a well-known professional selected by the most important companies of a medium size.

As I progressed in my studies during high school, my passion for physics became stronger, and I was determined to pursue a career in that field. By chance, I had a good teacher who suggested that I do something more practical than being a physician. He was a genius in Math and Physics, so, with his strong arguments, I was convinced by his advice to orient myself towards an engineering degree, which I chose to be within the electronics field.

The discussions with my teacher were quite productive as it stopped the continuous fights between my dad and me to allow me to decide my own life; as his wish for me, according to him, was very open; however, it was limited to whatever I would want within my city.

I chose to continue my professional studies in the public sector, something unknown to me until that time, as my mom pushed strongly to get ourselves educated in private schools all along our lives, even if that implied a higher cost and certain compromises within our family choices.

I got the results of my French test, which I passed, the same day as I got the job offer in 2006. It was a tough decision, to take the job or to work towards a Master's degree in Europe. But,...I realized how important it was for me to spend time with my best friend, a priest almost 60 years old who was not only part of my family as a close relative who became my best friend and tremendously influenced my life to now. As he was a wise man, I thought that I would always have the opportunity to do a Master's degree in the future, but to spend time with him to polish my personality and become a better person, I would have only a certain period of time. So, I remained in Mexico until 2013, three years after he died.

Desire for Practical, Concrete Outcomes

[I selected the field of electronics engineering] as I could really see tangible things happening, which...reinforced my need to see some concrete aspects to which I could contribute.

Private Education Spoiled Public Education

The root cause of [my dissatisfaction with my university] might be that I was used to a private education, with very organized schedules, discipline, and respect in our classrooms, even more towards the teacher. Whereas,...[my] public university had a lot more experienced teachers and better facilities,...the organization was simply not existing there. Teachers could show up or not. Students could come to class or not, and they were free to behave in the classroom as they wanted.

Public education in Mexico, other than in professional studies, like universities, is not good...education is very politicized, in the sense that there are a lot of unions that govern the entire system and take advantage of the benefits of having a good position within the public sector, such as early retirement with very high wages, many holidays per year (around 3 months), along with the possibility to pass on the position to one of their family members. Therefore, most teachers might not be...eager to engage in the education of their pupils.

Language Study, Travel, and Internships Opened Doors

Finally, I dedicated a year of a break [from university] to learn French and continue my piano practice. I went back to university with a clear goal that I would obtain my degree to pursue a Master's degree to work in the development of medical-electronics devices to improve people's quality of life. As this Master's was available in Belgium, Luxembourg, and France, with six months in each country, taught in French, with internships two days per week in different labs to decide the field for your thesis.

During my career studies, in September 2003, I had the opportunity to travel to Europe, specifically to France, Italy, and the south of Switzerland. I was fascinated by the order of the cities, their architecture, all the history that I was able to step into, the languages with their accents that vary from region to region; the different tastes of the food, from a very stylish combination in Paris to a natural taste of a good pasta or pizza.

After that trip, my desire to continue my studies in Europe became stronger. So, I worked harder, prepared myself to pass the French test certificate, DELF (Diplôme d'études en langue française), which was a requirement to apply for a Master's degree. I traveled and lived in Geneva for a month, in November 2005, for an intensive French training program, in order to take the exam in the beginning of December, which results I would obtain only three months later.

During my career, as part of my studies, I did an internship at Xerox, in a department in charge of developing tools to automate the production lines, in order to avoid defects and improve cycle time. I believe that doing an internship contributed to getting a firm job offer as a test engineer.

Importance of Setting and Adjusting Priorities

I came to France to continue part of my career plan, but I redefined what I thought the world and I required as skills.... Not someone dedicated to research in a medical field, but someone who could be an asset in management and intercultural skills that I discovered along my job history.

Need for Back-up Plans

Gonzalez Hernandez shared her disappointment with her Master's degree program. While being promised that there would be no more than two people in classes from any one country, half of her class of 28 were Chinese, 5 were Mexican, and 4 were Indian. And during the welcoming speech, the director told the students, "You're only in Paris once, so have fun!" She immediately went to the program office to complain. But, a Canadian friend told her that she had no choice but to continue to complete the

degree as she had no back-up plan. So, reluctantly, she stayed and finished. [If she hadn't, we would never have met.]

Short-term Costs Can Lead to Long-term Gains

The cost of the master's program was excessive (with eight years of savings gone in one year), but, in spite of initial reservations, there were some wonderful outcomes from the investment: meeting students from countries she could not even identify on a map, taking many elective courses to acquire a broad scope of exposure, having faculty members from across the world, and learning different cultural values and practices.

[One of my most rewarding experiences has been] being confronted with different values and learning to respect, even to understand, other ways of living.

Challenges: Patience and Knowing You Will Not Fit into the Culture

The first semester was...a good preparation to integrate into the French system; lots of documentation, forms to fill in, and different appointments with the immigration department.

I'm not sure about offering the degree in English....It definitely limited the opportunity to interact with the French culture, though English did allow for freer interchange among all students, providing a common language.

Developing a Circle of Friends in France Takes a Long Time—and May Not Happen

A major personal challenge, definitely, is to adapt and be patient and to accept that you will not fit into the culture, but it is good that way. This requires accepting that entering into the French society and being able to develop a circle of friends takes a lot of time and might not occur.

Extensive and Slow Bureaucracy Related to Forms Is a Challenge!! (This is actually the reason why McLean stopped teaching in France.)

Another challenge is putting up with all the paperwork and their very slow procedures to become "legal" in their country. For instance, a French citizen grows into their system, gets a birth certificate, social security number, vaccination, and so on. In my case, I needed to bring myself to the level of a French person who grew up within that system, and it takes a lot of time and follow-up continuously, as your documents might arrive at a different desk or office every time, so you must keep track of all the letters and information you may have submitted, via a traditional courier system. This applies to all the work that you do on a daily basis, besides your full-time job, to fill in documents for social security in order to have a card that allows you to go to the doctor. Then, following up with the taxes that are very significant, especially if you are single and living on your own, without any family in this country.

Learning to Value My Own Culture

Another challenge was to accept that we are different, while also valuing my Mexican heritage. I have seen here that some people dare to say, "it is not my job," and they will not even look for a way to help you out, whereas, in Mexico, I have seen that, even

if it might not be the safest or the best design, we will always come up with an idea to facilitate our life and help someone else, but maybe I'm biased.

My View of the World Is Changing, More of a Global Citizen

Those projects allowed me to have interaction with people from other countries and areas.

I accept that I'm changing my own views of the world by living in this environment and being exposed to all these different experiences.

May Not Be Able to Go Back to Mexico to Live Again

Going back to Mexico will always be an option for me; however, I would like to keep it as an option and not part of my master plan for my career.

I acknowledge that this is getting me even further away from my own culture and country, implying that, indeed, even if to me going back to Mexico would always be an option, deep down within me, I'm certain that I might not be able to fit back in again.

Personal Growth Has Occurred

The most rewarding aspect has been exposure to all the learning possibilities and opportunities that this has opened up for me, with regards to my professional career and my personal development and growth. My personal growth and maturity has led to being more independent, more responsible, and more aware and determined as to who I would like to be and what to do to achieve it.

Live Without Regrets

To value every second of my life, whether I am in Europe or traveling or with my family or friends, each moment that has passed is gone, and is not going to come back. Therefore, my strong determination is to try to live without regrets, doing the best I can, every time, even if it takes more effort, or if I'm able to accept that it is not being right that matters to me but being, rather, at peace with myself. To enjoy the smell of a freshly baked baguette, the luxury of walking in one of the most beautiful cities in the world, even if it is dirty and disorganized, and sometimes daily life and its procedures, along with the continuous complaints of the French, may drive me crazy.

Learning to Ride a Horse Has Been Rewarding

To be able to get into horse riding, even if I haven't mastered this sport yet, it has shown me the importance to continue to learn more about myself, in order to be able to act in a wiser way and the relevance of handling myself to be able to manage others.

Surprised by Gender Sharing of Home and Family

I was surprised by the collaboration between women and men regarding shared responsibilities at home to raise a family or simply live as a couple. As the living costs are very expensive, at least in Paris, both wife and husband must work and have an active life, meaning business trips and arranging all daily activities at home, groceries, school for the kids, and so on.

Small Living Spaces; Long Commuting Times

I was surprised by the very limited space to live. In Mexico, a house of 200 square meters is the minimum that we consider to be big enough, whereas here apartments of 20-40 square meters could have one, two, or three persons. There are houses but they are located in the surroundings that make the commuting time a lot longer, varying from 45 minutes to one hour and a half.

Collaboration between Business and Government to Encourage Leisure Activities

Given the cost of living here, I was surprised by the number of advantages that the CE (comité d'entreprise) works on, together with the government to encourage the practice of a sport, attendance at cultural events, take trips along with your family and work colleagues to specific places like Greece, South Africa, etc., with a special price.

Impressed by Local Transportation

Public transportation gets you everywhere all day long, even to remote places very far away from the city.

Local Pride in Wide Variety of Food and Beverages

I am impressed by the varied selection of beers, wines, cheeses, breads, local products from all regions within France and Germany that make their citizens very proud.

Pride of Nationalism, Though Tempered by Opposition to Immigrants

I was surprised by the sense of belonging to their nationality and its roots within history, but sometimes it is used for their convenience, mainly regarding the number of immigrants today. The diversity of cultures and nationalities can be seen while using public transportation. Sometimes the subway line is an indicator of the people living in that area--tourists, Parisians, or those with African, Indian, or Chinese roots.

Literacy, Widespread Reading

Their level of literacy; you can observe a lot of people reading the newspaper or novels while they go from one place to another. Today, a lot of young people, in their vast majority, are reading or playing on their mobile phones or chatting via internet applications.

French Regions Take Holidays at Different Times to Allow for Greater Freedom of Movement throughout the Country; Smart Approach

The French government has done interesting planning within the country so not all regions in France take holidays (school related) at the same time, a smart way to ensure appropriate ways of transportation to other regions, as well as to increase the time frame for business related to leisure, hotels, restaurants, museums. It is also a way to encourage their citizens to visit other regions in their country.

French and Germans Slow to Change

They have difficulty to adapt or to accept change. I've observed this not only in France, but also in Germany. France needs to pace its change, or the strong unions will paralyze the country.

French Have Limited Language Skills (Other than French)

I wonder if the reason that the French have tended to travel more domestically than internationally (though this is changing with the new generation) is because of their limited language skills.

Religion—Lots of Churches, Few Participants, Priests Pedantic

Religion. It surprises me the number of churches, even if the number of attendees is very small compared with Mexico. The priests' sermons are somehow rationalized according to French philosophers and its history. By serving as a catechism teacher, however, I discovered that their pedagogy uses many ways of learning: cutting, painting, internet, and so on. It is not limited to the Bible but it opens doors to have a more rational and informed practice of religion.

Youth Use Church to Do Missions for Broader Exposure to the World

The engagement of a lot of young people to do missions in other regions in the world is a way to discover a new culture, to practice language, and to help others.

3.2 Professional Learnings

The professional learning themes identified are supported by brief quotes, as follows.

Mergers and Acquisitions Are Numerous and Potentially Chaotic

Luz Maria's job history is marked by changes that occurred frequently through mergers and acquisitions (M&A), and her decisions, then, whether to stay with the new company or look for other employment. And in almost every case, she found that the M&A was poorly planned and often resulted in chaos. This appeared to her to be particularly the case with international M&As, especially when one of the parties was Chinese.

Exposure to Many Countries and Cultures as Preparation for Global Job

All of these experiences contributed to exposure to a lot of cultures; even though we spoke the same language, English, but our traditions, accents, religions, ways of living, were very diverse.

Traveling around the world, to Japan, a very organized, stressed, and respectful culture; to Brazil, a very rich country in their people, natural resources, amazing landscapes, but, in some cases, with poor leadership that leads by fear instead of developing good collaboration; to Mexico, very similar to Brazil, on those characteristics; to Hungary, with a beautiful capitol that lights up the city in a good balance of light, history, and culture, but it is a poor country, and I could see, still, the sadness and the pessimism of the people living in that country; to Spain, the north, with a factory that seems more a family business as it is located in a small town, and everybody knows each other, which makes it harder to manage, but it might be easier to work towards the same goals as it's the income source of the majority of its population.

One of my greatest learnings has been the opportunity to listen to all these different languages, cultures, views, and tastes that allow me to see how big our world is, as well as to smile when I try to do things in a perfect way.

Cultural Ignorance in Global Organizations

It took a bit of patience to see some results [of globalization awareness]. There were some natural errors, as sending an invitation to discuss with Mexico in the middle of their night; or requesting an urgent action when the day was already over in Europe; setting up an audit while there was a series of national holidays in one of those countries or during the long vacation summer period in Europe.

Sometimes, Opportunities Come in Unexpected Ways

By chance, at the end of October [the end of my internship], my boss approached me and asked me whether I would be interested in a full-time job as a project manager within her team. I didn't even think about it twice.

Manager Autonomy re: Strategy, Travel, and Budget Enhances Work Life

I appreciate the autonomy and independence, even as a student within a company, to choose my travel dates, go to Germany whenever I wanted, without providing a reason or a purpose for the trip, nor having to justify that it was part of the budget and already covered by a certain department or bill.

Face-to-face Time Is Important in Global Organizations

I cherished the continuous investment of the company in making an effort to meet face to face with colleagues by bringing most of them at least once a year to Germany, so that we could all get to spend dinner together besides the working times.

Women Treated More Equally in Europe Compared with Mexico

The most rewarding feeling that I have [as a woman] working in Europe is that I get to work in strategy, which products are required based on legislation changes or new product specificities; whereas in Mexico, even if I would be based in the HQ of a company, I [would be given a] narrowed view, being a woman within my field in Mexico. I get the impression that it would be very limited due to the number of men in those areas, and therefore it would be tough for me (or at least energy consuming) to prove that you are good at what you are doing, or that you know what you are talking about on a daily basis. I'm not willing to be exposed to that type of interactions constantly.

Importance of Timely and Accurate Communication

I was in daily communication with the customer in Toronto to ensure that whatever I was doing was correct and that the samples I received and installed were functioning as per their procedures...we made a lot of mistakes, and it took us several years to get the material to produce the controllers on a regular basis. This caused continuous escalation and meetings at the very top management level who would come to our plant to have specific reviews on this project.

When her manager requested a transfer because of his frustration with the project, Luz Maria approached her manager and volunteered for the position of engineering manager, even though she was only 25 years old, and the team consisted of 12 people, including three who were more than 20 years her senior. While surprised, the director discussed the request with the plant manager, and, through strong negotiations, she received the position with a major increase in salary and the ability to accumulate two years' of vacation into one month (instead of two 10-day vacations).

Motivated by Learning from the Job

Another aim that I had to come to Europe was to become or learn a more diplomatic methodology to employ, mainly during negotiations. I would like to be more assertive and less direct when it comes to express what I want. I had the impression that, in Europe, people are more diplomatic than when you are interacting in a North American environment, but it all depends on your experiences, mood, knowledge, and emotional intelligence.

I must admit that, by that time, I was too involved in the team and the activities, and I almost wanted to request an extension of my [internship] contract, even without salary, just to get to know the end of the quality topic, as it became a very interesting and rich learning experience.

Lateral Moves Can Be Promotions

One day, an uncle of mine told me that, if I couldn't go up in a position, to keep in mind that one could also grow by moving laterally... so, I took advantage of the time to learn from other departments and areas, which in the end helped me to understand better the product we were dealing with, as well as the customer and our internal challenges.

Importance of Cross-training

When first promoted to engineering manager, there was a shortage of materials available for the project. Luz Maria took advantage of this situation to become involved in many other aspects of the plant's operations, learning about many of the projects and functions involved in the plant, including aspects of customers' operations. But she also recognized the benefit for other engineers:

Three of my engineers, given their ages and history, had the right to more than 30 days of holidays per year. They had foundational experiences in the most critical production areas, therefore, allowing to take holidays was an imminent risk....So, I started a training plan....to diversify their knowledge....there was reluctance to the change, mainly two out of the three. This forced me...to take advantage of recently graduated engineers to rotate them...to gain maximum knowledge...[by] supporting and accompanying the experienced ones. In the end, after some problems,...we were able to overcome the difficulties...[with the assistance of] customers, as well as willingness to learn new things and face new challenges from the recently graduated engineers.

Challenges of Being a Young Person in Top Management Roles

Specific skills were required in the function [of program manager]: negotiation, in order to build alliances...but also be prepared to be criticized and not welcomed, being

the youngest person in the top management of the factory, governed until then by men in their 40s or 50s...the challenge to manage my team of colleagues with whom I had already worked for more than three years was not so hard, as I had gained their respect and, also, the customer was always very supportive and eager to [work with me].

Customer Support Enhances Opportunities but Can Also Lead to Internal Conflict

The customer identified me as a key person within my own company...so, they were constantly providing me with guidance, training, and more visibility in the project milestones to understand better their needs to give me arguments to convince and drive my internal organizations. However, this might have also been a contributor to a series of misunderstandings between myself and the new plant manager, as he thought that there was a conflict of interest, even if I proved him wrong all the time.

Friendships Develop from Good Professional Relationships

Most of my customer interfaces became very good friends up until now, as we were able to be professional in our daily work but have personal interaction via dinners, skiing, visiting parks, attending backyard BBQs, attending family baptisms and funerals, and so on.

Need for Support from Supervisors and Upper Management

I must admit that my main headache was the new plant manager and the lack of support of my boss.

MBWA (Management by Walking Around) Is Critical

[In our plant in Sweden,] the director of the plant would pass by their areas every morning to say hello to each of them....Not only due to the education of the people, but also by feeling that they had choices, it didn't feel that they were working in the production line as slaves, that they did not think that this type of job diminished their personal value.

Our new plant manager wanted to do all this by managing from his desk or in meeting rooms, implementing more reports, doing a tour of the production floor only once a week to review the list of open actions....This was a completely different approach as to how I was operating and working within my team for a couple of years. My daily routine started by opening my office, turning on the computer, and, while the PC was downloading the emails, I would go to the production floor to check up on the people, production status, get the reality to present or listen to the reports in our daily morning meetings....After that meeting, I check up on my emails and prepare for our production and engineering meetings on the production floor to review the status from all the different teams and departments, quality, production, materials, and engineering.

Two Stubborn People Who Will Not Listen Leads to Impasse

We [plant manager and me] were both very stubborn, and none of us was eager to listen the other's point of view. So, he kept pushing me to change and improve the production line in order to become lean; however, he never understood that our type of product was not meant for that, as the complexity of the products, along with its

production cycles, were very different.... It was really ridiculous, for instance I had budgeted a trip to Sweden to launch a new project, for five engineers, he only approved the trip of three and shorten the duration of the trip from one month to two weeks, without any valid arguments, other than money. However, he did request me to invoice to the customer the entire portion of the budget for that trip. After that, a series of fights continued, even on the production floor, as he was a very aggressive person with a strong character and I would continuously challenge his orders, to...give him a hard time and show him that he might have the position but not the power to make me do whatever he wanted to.

Defending Employees Publicly Before Manager Can Lead to Negative Outcomes

I believe that my main problem was that I acted as the defendant of my team, so it became a personal fight that ended up getting most of my team fired or assigned to another department, until I handed in my resignation letter to move to [another] company.

Having Experience in the Industry Is Helpful

The company I moved to is in a market that is in continuous growth within my city and the country, even today, and, as most of the companies in that sector require, in order to hire you, certain experience within the field as they consider it to be very aggressive, given the procedures and penalties in case of a line stoppage.

Luz Maria was transferred to Mexico working with a woman boss, reporting to a headquarters in the United States. Her assignment there was to learn more about the industry.

Short-term Thinking via Stock Prices Leads to Stress and Uncomfortable Work Environments

I mentioned the company's culture, as is part of the stock exchange in the United States. I have never before seen in any production line indicators of the price of the action of our stocks. The levels of stress in this industry, as well as the number of layoffs, from one minute to another, were to be considered.

Everything Revolves Around Food in France

Cultural wise, I believe this is what has surprised me the most. In France, all turns around food. Time schedules for meetings; lifestyles, like going to the movies or theater; having an appetizer prior to dinner at a certain hour so that afterwards you are able to enjoy a nice plate with a good wine and cheese; even signing a contract, even though the European rules restrict costs to entertain a customer to no more than 25 Euros as it could be interpreted as bribing to obtain business or have access to sensitive information.

Positive Workplace Environment in Europe Is Important to Sustain Work Life

I would say a very rich opportunity [was] being able to work directly in the HQ of different companies and nationalities. For instance, seeing that their buildings have several types of restaurants and food chains inside, a manicurist, banks, and even a hair dresser, shows a little bit of the work life in that environment.

Germans Switch from English to German to Prevent Understanding

[Another important learning occurred by] being part of critical negotiations, when the Germans switch automatically from English to their language, to limit the number of people that are able to understand and follow their discussion.

Optimal Company: “Balance Good Life of France with Some German Organization”

I decided to take on a new challenge in a similar type of company, still within the same segment but with an HQ and a structure from Germany, as, in my opinion, the optimal way to balance the good life of France is with some German organization.

Professional Autonomy Important to Job Satisfaction

So far, my experience in the new company has been positive regarding training plans, the autonomy to decide whenever I needed to travel to our HQ or any of our factories, in addition to the independence to arrange my working times and, even, to define my own job description and organization, despite the fact of confusion that might imply to have a functional boss based in Germany and a French hierarchical boss who works from home, and I have only seen once in a special meeting in Germany, since I started.

Knowledge Transfer Is Not Emphasized in Europe

I have noticed that, in Europe, knowledge transfer is not very important or a priority, in the sense that there is a lack of documentation of the activities that a person is doing, while in Mexico, at least in one of the companies for which I worked, documentation was key to be able to rotate personnel on the production floor, and this might be the reason why employees remain for a long time in their jobs, and they just built on competences and define their own personal career path, making it very hard to establish a career plan in case of an M&A. I would have liked to have something more structured, in the transition phase of my new job, as it's not so evident to replace someone who has been in this role all of her professional career, going from chemical engineer to project manager, then to sales manager and now to key account manager.

Constant Flow of E-mails in Lieu of Face-to-Face Communication

A relevant topic that is taking me a lot of time to get used to is the communication based only on emails, as a result of the benefit provided allowing home-office work, continuous flow of emails with a very limited size of storage on our mailbox, 600MB compared to the unlimited capacity that I had on my previous job.

Romania is Low on Risk Taking

It might be a cultural difference with respect to Romania. The colleagues that I have dealt with are so afraid of making decisions, not respecting a specific order or not having training to answer a document. They don't seem to be eager to take any risks nor to go further than their job function requires. (As I have not visited yet the factories there, nor met the colleagues directly, I'm only talking about the first impressions that I make based on some issues we have dealt in the past weeks.)

Many French Employees Work from Their Homes

We have in Paris only 13 employees; the rest are based in Lyon, but a lot of people are able to work from their home....The intention is to be flexible to cope with the

commute times. However, in my opinion, this disrupts teamwork, the sharing of knowledge and communication.

Some French Are Sensitive to Accents, Even When Speaking Perfect French

Even if you speak fluent French, there is an accent; some people might make the effort to understand you, while others will hang up on you if you are talking over the phone. I have found that French have a very sensitive ear when it comes to pronunciation.

Some French Have Outdated Images of Mexico (Tequila and Sombrero)

I would also mention their impression of what a Mexican is, as some of them have still the picture of a guy sitting in the ground with a bottle of tequila and a hat (sombrero).

Some French Discriminate Against Immigrants, Especially in a Protectionist Way

Even if it is not publicly stated, you are somehow below their cultural and educational level; to a certain degree, you are being discriminated against as they are very protectionist within their own society.

In France, Need to Justify Being a Manager When Trained to Be an Engineer

I've discovered during job interviews that their way of thinking is quite particular. In France, it seems weird for them that having an engineering background, I'm not working as an engineer. Even if they don't say it out loud, I have felt judged that I didn't choose my career in an appropriate way, in the sense that you get the feeling that their expectation is that, if I studied engineering, I should always be an engineer.

Therefore, it is hard to justify my professional experience that, personally, I consider very rich and wide, as I have, in my opinion, a general view of most departments and functions within a company. However, for most of the French people that I have encountered, it seems as if I'm still not sure about what I would like to do, uncertainty, which they avoid.

Germany Is More Accepting of "Coming to the Career Later" but Are Curious

In Germany, the approach is quite different, not in the sense that they value my experience, but in their willingness to understand when and how you discovered what you wanted to do. They are very curious about it and how you worked towards achieving it.

Lot of Emphasis in Europe on Diversity and Gender Equity

To be sincere, nowadays in companies there is a lot of publicity and advertising regarding diversity and gender equity, even if I have never felt that way in any of the jobs or companies I have worked in Europe so far; I don't know if this [employing me] is a way to justify it in terms of their organizational targets.

Number and Impact of Unions Is High in Europe

The number of unions existing in each European country is much higher than in Mexico and depend on the type of industry, product, and history. And the unions in France are much more powerful than the unions in Mexico.

4 Discussion, Recommendation, and Conclusion

Autoethnography is not designed for generalization. What has been reported here is the experience of one Mexican woman in her limited experiences working as a self-initiated expatriate as an engineer and manager in Europe. What has been evident in the study is the value of reflection on one's experiences and the insights that can be gained. In fact, at one point, Luz Maria said, "but maybe I'm biased." The reality is that we are all biased; there is no way that we can reflect on our life or work experiences without seeing them from a subjective, idiosyncratic perspective. We kid ourselves when we think that we are being objective. Gonzalez Hernandez, at the end of the project, commented on what a good experience this has been for her, giving her new insights into her career, but also in her personal development.

Unlike many company-initiated expatriates, who typically receive very little preparation for their experience in another country (McLean, Kim, & Pruetipibultham, 2017), Gonzalez Hernandez's self-initiated expatriation involved extensive preparation, including the study of language to a high level of expertise, learning about the country through immersion while studying for her master's degree, and extensive self-funded travel around Europe. From her self-reflection, these efforts enhanced her success in her managerial roles in France.

Another intriguing factor about her preparation is the extensive and comprehensive nature of her preparation for life, including extensive reading, playing the piano, travel, mathematics and sciences, language, religion and philosophy, horseback riding, and other areas not typically anticipated in the preparation of a future engineer or manager. The fact that she has enthusiastically engaged in the development of this paper, the second one that we have developed together, is another example of how she is willing to step outside of the wheelhouse in her professional development. There is no professional reward for doing so, except for her own satisfaction in self-development.

Gonzalez Hernandez's reflections are full of references to culture and values. This is not surprising, given the extent of the differences between Mexico, France, and Germany. Nevertheless, it is also important to see how she has coped with such differences. Yes, there were times when she experienced culture shock. Yet, she was patient and persistent in working to understand the source of the differences and to find ways to incorporate those differences to her advantage as a manager.

While the literature is full of ways that companies need to support expatriates before, during, and after their expatriation (McLean, Kim, & Pruetipibultham, 2017), Gonzalez Hernandez had none of these resources available to her from her employer. Yet she successfully navigated the culture streams, becoming a successful manager, in spite of her age, her gender, and her culture working in the strong cultures of France and Germany. So, perhaps, the solution to the problems of company-initiated expatriation is one of selection, rather than development.

Another factor that may or may not have been to Gonzalez Hernandez's benefit is that she is single. The advantage to this may be that she has not had to be concerned about the adaptation of a spouse to a new culture. She also does not have children to be concerned about. On the other hand, she had to face all of the issues of culture by herself. As a strong, independent woman, this appears not to have been an issue for her.

From a practical perspective, the basic recommendation is that other self-initiated expatriates engage in critical reflection and dialogue through autoethnography. Not only will this have value personally, but it will also have benefit to the HRD community as it is shared through publication.

References

- Alagaraga, M., & Wilson, K. (2016). The confluence of individual autonomy and collective identity in India: A narrative ethnography using an Indian-U.S. sociocultural lens. *Advances in Developing Human Resources*, 18(1), 26-37. doi: 10.1177/5234223/5615090
- Chien, T-C, & McLean, G. N. (2011). Intercultural training needs of U.S. business expatriates in Taiwan as perceived by U.S. expatriates and their Taiwanese colleagues. *Journal of European Industrial Training*, 35(9), 858-873.
- Grenier, R. S. (2015). Autoethnography as a legitimate approach to HRD research: A methodological conversation at 20,000 feet. *Human Resource Development Review*, 14(3), 332-350. doi: 10.1177/1534484315595507
- McLean, G. N., Kim, J., & Pruetipibultham, O. (2017). Developing expatriates/inpatriates. In T. Garavan, A. McCarthy, & R. Carbery (Eds.), *Handbook of international human resource development: Context, people and process* (pp. 315-335). New York: Edgar Elgar. (<https://www.elgaronline.com/view/9781781954171.xml>)
- Polesello, D., & Stout, K. E. (2018). International adjustment of Brazilian expatriates in the United States of America. *Human Resource Development International*, 21(1), 46-65. doi: 10.1080/13678868.2017.1357400
- Ridgway, M., & Robson, F. (2018). Exploring the motivation and willingness of self-initiated expatriates, in the civil engineering industry, when considering employment opportunities in Qatar. *Human Resource Development International*, 21(1), 24-45. doi: 10.1080/13678868.2017.1340075
- Sambrook, S. (2016). In (re)search of the self: Autoethnography in HRD research. In M. Saunders & P. Tosey (eds), *Handbook of research methods on human resource development* (pp. 92-107. Northampton, MA: Edward Elgar.

Determining Employees' Loyalty by Informal Communication Structure in College

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Abstract: The topic of the relationship between employees' corporate loyalty and their informal communication structure remain uninvestigated in Russia. This research makes a step in exploring the field by checking the existence of such relationships and allocating its features basing on the example of one of the Colleges of Saint- Petersburg. To identify and measure the relationship we combined Job diagnostic survey by Hackman and Oldham and sociometry. The correlation and regression analysis results supported the hypothesis about the existence of the connection between employees' satisfaction, loyalty and informal communication structure in educational institution. The research could be useful for the management of the College, similar educational organisations and those who want to check the relationship between loyalty and informal communication structure within their organisations.

Keywords: net promoter score, social network analysis, college, job satisfaction, informal communication

1 Introduction

Employees are a fundamental element of business processes, which is the reason for keeping track of them by managers (Ruck&Welch, 2012). Engaged employees follow company's values and appreciate the corporate "climate" (Harter, Hayes & Schmidt, 2002). In a long-term perspective, the level of engagement also affects employees' attitude and trust to the supervisor and, as a sequence, to an overall loyalty to the organisation.

Employee's loyalty has been previously studied in the framework of such disciplines as internal marketing, sociology and psychology. Researchers state that control and evaluation of employee's satisfaction are of importance for business (Rachel, Yee & Yeung, 2010, Harsky, 2003, Hajdin, 2005). Employee's loyalty has a substantial impact on business outcomes (Harter, Hayes & Schmidt, 2002). However, these studies do not take into consideration social networks among employees as one of the aspects influencing loyalty level. Moreno (1951) and Wasserman (1994) determined the crucial role of social networks in understanding formal and informal communication structure and establishing the productive system of cooperation in a company.

This research is aimed to identify and explore the nature and the features of the relationship between employee's satisfaction, loyalty and informal communication structure in an educational institution. The unit of study is an employee (teacher, manager, specialist) from one of the colleges in St Petersburg, Russia. This research has a case study design, but the results may be generalised to other educational institutions (schools, colleges).

2 Literature review

2.1 Loyalty and satisfaction of employees

There is no consensus considering the definition of employee loyalty. Thus, Schrag (2001) defines employee loyalty as the attitude of employee manifested in well-wishing, identification, reciprocity and sacrifice which involves a commitment that can be offered by the employee but cannot be demanded or claimed as a duty by the organisation. Yee and Yeung (2010), in turn, assume that employee loyalty refers to employee's feeling of attachment to his/her organisation which is reflected in intention to stay in a company, sense of belonging, willingness to perform extra work and take up more responsibility. The same position has Mehta (2010), who states that employee loyalty is an emotional attachment which can be divided into two dimensions – internal (feelings of commitment, caring and affiliation) and external (the way employee shows his/her loyalty).

In our research employee loyalty is presented as a set of employee's characteristics caused by his/her qualities (internal factors) and organisational qualities (external factors), which influence the attitude, the behaviour and the intentions of the employee to the organisation in the current and long-term period.

Rachel, Yee and Yeung (2010) claim that employee's loyalty is a significant determinant of firm's profitability. They highlight the importance of loyalty in satisfying customers which in turn positively influences customers' loyalty and company's performance results. Harter, Hayes and Schmidt (2002) state the same results. The meta-analytic study revealed that employee's (satisfaction and engagement) are related to significant business outcomes (productivity and employee turnover).

2.2 Informal communication: definition, analysis and visualization

Organizational structure is a regulated system of stable relations between all elements of the organisation, both subdivisions and individuals (Wang et al., 2015). The structure of communication exists in two formats: formal and informal ones. The formal one is presented in the form of organigram, and the informal has more diverse ways to be described.

Allen (2007) considers informal communication to be a platform for discussing performance appraisal and organisational management. Hitt et al. (2006) define informal communication as the patterns of communication that occur at the organisational level. Overall, informal communication is a channel between the employees in an organisation, who share information, attitude and emotions, by grouping based on shared values and ideology.

Social networks work as the mechanism of knowledge and information exchange in a company. For some people, this mechanism acts as a primary source of information in comparison to the appearing documents or announcements (Behrend, 2009). The importance of the social ties cannot be underestimated both for management and employees themselves (Lawson et al., 2009). Shared social ties result in similar views and attitude towards different aspects. That is why it may also be a reason for a level of loyalty (Tamer et al., 2012).

Hanneman (2001) distinguishes two ways to visualize the informal ties between employees: graphically and in a table format. Moreno (1951) offered the most commonly used way to visualise and analyse social networks of employee – sociometry. Sociometry is the instrument for measuring the interpersonal connection between people. It evaluates and presents every interpersonal link and creates the overall picture of the informal social network within the group.

Behrend (2009) describes sociogram as a typical and visually understandable way to show the information about members' identification of each other and number and firmness of ties between them. Such scheme reflects the information about the levels of authority and knowledge-exchange channels among participants. Sociogram provides managers with an insight of the existing informal networks and, therefore, makes it possible to transfer information in the specific direction to ensure its correct spreading. For such manipulations, it is worth identifying the core of each community. Identification is possible by testing links using the method suggested by Grivan and Newman (2002), who build the original map by detecting most central and most distant edges and cluster them on the hierarchy. Also, Wasserman and Faust (1994) offer a set of indicators for measuring informal relations in the sociogram – centrality indices. We will discuss them in methodological section.

3 Methodology

3.1 Sample and population

The population consists of 50 employees of one of the professional colleges in St Petersburg, Russia. The group of employees is represented by foreman (instructors or masters), subject teachers and administration and specialists. Each member of the population received a questionnaire, so the initial sample method is the census.

3.2 Questionnaire

To collect quantitative data on employees' loyalty, satisfaction and informal communication we created an offline-distributed questionnaire. The questionnaire consists of three groups of questions, each one taking into consideration unique features of the educational institution (college). The first group of questions measures the loyalty, satisfaction of employees. We use NPS (net promoter score) and Job diagnostic survey as a basis for this part (Hackman & Oldham, 1975). The description of the included features of employees' satisfaction is Table 1.

Table 1: Description of the scales of the data collection instrument (questionnaire)

Name of the scale group	Name of the scale	Scale description
Core characteristics of professional assignments	"Variety of working (professional) skills."	Allows assessing whether the employee has the opportunity to apply all his abilities, professional knowledge and skills; whether the job is challenging for the professional competence of the employee.
	"Completion of the working task."	Allows assessing the extent to which an employee must perform the task fully and how significant is his impact for the final result. In other words, whether the work is performed by this employee from the very beginning to the end with a visible result.
	"Significance of a working task."	Describes the employee's perception of how does his work influence life and work of others.
	"Autonomy"	Describes the level of freedom, independence and responsibility of the worker while choosing the mode of operation and the procedures necessary for its implementation.
	"Feedback from work."	Allows evaluating whether the work itself provides direct and understandable information about how well is it performed.
	"Feedback from others."	Allows assessing whether the employee receives understandable information about the performance of his work from other employees and managers.
	"Interaction"	Reflects the level of interaction with the members of the organisation they work for, colleagues from other companies and customers while performing work tasks.
Cognitive evaluation of their qualitative working results	"A realised meaning of work."	Allows understanding, whether the employee evaluates his work as significant, valuable and worth.
	"A realised meaning of the work results."	Defines the level of personal responsibility of the employee for the results of his work.
	"Understanding the real work results."	Allows to estimate the continuous (covering all stages of implementation) level of knowledge and understanding of the results of their professional activities.
Emotional evaluation of the results of their professional activities	"Overall satisfaction."	A generalised indicator that reflects the degree of overall employee satisfaction with professional activities.
	"Intrinsic work motivation."	Reflects the need for the employee to perform their work for its own sake or original goals and positive feelings (interest, optimism, joy) that he experiences when the work is performed well.
	"Satisfaction with the opportunity of professional growth."	Shows the degree of satisfaction of the employee provided at work with the opportunity to grow professionally and develop.

Name of the scale group	Name of the scale	Scale description
Different aspects of satisfaction	"Satisfaction with the low risk of losing a job."	-
	"Satisfaction with the salary and other payments."	-
	"Social satisfaction."	Characterizes the degree of employee satisfaction with the interaction with other employees of the organisation.
	"Satisfaction with the management."	-

The NPS index is calculated to evaluate the level of loyalty among employees. NPS is often used as the method for evaluating loyalty, both consumer and corporate, as the willingness to recommend the company to friends/relatives is considered to be one of the best indicators of loyalty (Guillon & Cezanne, 2014). The survey suggests the question «How likely would you recommend the College as a working place to your friends or acquaintances?» The higher the mark on this index, the higher level of loyalty is. For calculating NPS, all respondents are divided into three groups:

- "promoters" (mark 9-10) – those who actively recommend the company as a great place to work;
- "passives" (mark 7-8) – those who have the neutral position, they are generally satisfied with the company, but wouldn't recommend it;
- "detractors" (mark 1-6) – those, who are both dissatisfied and wouldn't recommend the company.

The second group of the questionnaire is a non-anonymous block, where an employee should answer six questions that will help to define informal communication structure. These questions are based on the sociometric technique developed by Moreno (1951) and Wasserman (1994). We group the questions into two blocks by the feature of communication – trust-related and work-related. The example of questions is in Table 2.

Table 2: Sociometric questions in the questionnaire

#	The question (sociometry)	Nature of communication
1	"Who do you ask for professional help among your colleagues?"	Communication on work-related issues
2	"With whom of your colleagues, you would prefer to go on a business trip?"	Communication on work-related issues
3	"Who do you ask for advice in difficult life situations among your colleagues?"	Trust communication
4	"Who among colleagues would you invite to your birthday celebration?"	Trust communication
5	"With whom you communicate most often among your colleagues?"	Communication on work-related issues
6	"Who do you trust the most of all among your colleagues?"	Trust communication

The final group of questions measure socio-demographic features of the respondents: gender, age, position and financial state.

4. Results

4.1 Descriptive statistics

We collected data from the 26th of January 2017 till 24th of February 2018. Administrative staff filled questionnaires online while others were interviewed face to face. 47 answers were received as the rest of employees refused to participate. 45 answers are identified, and two were left anonymous in the online version of the questionnaire. The prevailing percentage of respondents are women. There are 26 (55%) of them and 19 (40%) of male employees. The working staff consists of 23 subject teachers, 16 masters (instructors – foreman) and six members of the administration. Most of the employees are working in the College for 2 and more years when only 29% of them are "newcomers". People working in the College are mainly related to the middle-class income group. The descriptive statistics on sociodemographic features of the sample is in Table 3 and Table 4.

Table 3: Descriptive statistics for the sample

	Group	Number of answers	Percentage	NPS
Gender	Female	26	55%	23,0
	Male	19	40%	36,9
Profession	Administration	6	11%	33,4
	Teacher	23	49%	17,5
	Master	16	34%	53,4
Experience at the College	Less than one year	13	28%	38,6
	From 2 to 5 years	19	40%	-11,1
	From 6 years	13	28%	84,6
Income level	Low	4	9%	-
	Below middle	9	19%	-
	Middle	23	49%	-
	High middle	7	15%	-
	High	2	4%	-

Table 4: Descriptive statistics on the socio-demographic group of questions

Indicator	Average	Median	Standard deviation	Minimum	Maximum	Number of observations
Age, year	42,76	42	14,63	23	69	45
Working experience in the College, year	7,4	2	10,31	0,5	44	45
Total working experience, year	22,02	19	14,91	0,5	48	45

The data collected for analysing the structure of informal communication is used to build sociograms to see the structure with the help of ORA-LITE software. After building sociograms, centrality indexes were calculated to identify the most critical employees. We calculated three degree and centrality measures for each of the sociometric questions. These measures represent the structure (density) of the informal communication between the employees. The description of each measure is in Table 5.

Table 5: Centrality and degree measures of informal communication structure

Centrality measure (title)	Description	The possible range of values
Betweenness centrality	The degree of which nodes stand between each other. A node with higher betweenness centrality would have more control over the network because more information will pass through that node (Freeman, 1997)	[0;1]
In-degree centrality	A count of the number of ties directed to the node	[0; the sample size sets the upper limit] normalized – [0;1]
Out-degree centrality	The number of ties that the node directs to others	[0; the questionnaire sets the upper limit] normalized – [0;1]

4.2 Employees' loyalty and satisfaction

To measure the level of employee's loyalty, the Net Promoter Score is applied. Following their choice, respondents are divided into three groups: "promoters" (mark 9-10), "passives" (mark 7-8) and "detractors" (mark 1-6). 51.1% of the participants are "promoters" of the College, 25.5% belong to the "passive" group, and 23.4% are "detractors". The NPS index for all employees is 27.7 points in contrast to 40 points and above recommended. According to the classification of NPS indexes results from 25 to 39 are average without the outstanding level of loyalty among employees (Yashkina & Sklyar, 2012).

The NPS was calculated for grouping people into several categories: by profession, gender, experience (Table 4). The most loyal respondents are masters, people working with the College for 6 and more years. People cooperating with College from 2 to 5 years are profoundly convinced not to recommend the College to others. Moreover, male workers tend to be a bit more loyal, than women. Administrative staff indexes hardly prevail the teacher's one, showing weak tendency to recommend the College.

To measure employees' satisfaction level, we calculated a set of indices following the Job Description survey (Hackman & Oldham, 1975). The descriptive statistics on each index is in Table 6.

Table 6: Descriptive statistics on satisfaction indices

Satisfaction indices	Min	Max	Average	St. Deviation
"Variety of working (professional) skills."	4,33	7,00	6,37	,66
"Completion of the working task."	3,67	7,00	5,71	,99
"Significance of a working task."	4,00	7,00	6,23	,73
"Autonomy"	2,67	7,00	5,72	1,11
"Feedback from work."	3,67	7,00	5,81	,93
"Feedback from others."	1,33	7,00	5,13	1,42
"Interaction"	4,33	7,00	5,87	,78
"A realised meaning of work."	4,25	6,50	5,57	,53
"A realised meaning of the work results."	4,00	7,00	5,41	,87
"Understanding the real work results."	4,33	6,83	5,79	,56
"Satisfaction with the opportunity of professional growth."	1,75	7,00	5,81	,87
"Satisfaction with the low risk of losing a job."	2,00	7,00	5,78	1,23
"Satisfaction with the salary and other payments."	1,00	7,00	5,32	1,62
"Social satisfaction."	5,33	7,00	6,16	,46
"Satisfaction with the management."	3,33	7,00	5,94	,84
"Overall satisfaction."	2,40	7,00	5,46	1,08
Overall loyalty (from 1 to 10)	1,00	10,00	8,06	2,46

4.4 Structure of informal communication

To capture the structure of informal communication among employees, six sociograms were built. These sociograms were aimed to reflect the density of work-related (Figure 1) and trust-related communication (Figure 2) among the employees in College. Colour coding represents the position of the employee.

Question 1. "Who do you ask for professional help among your colleagues?" (Indicator of working relations)

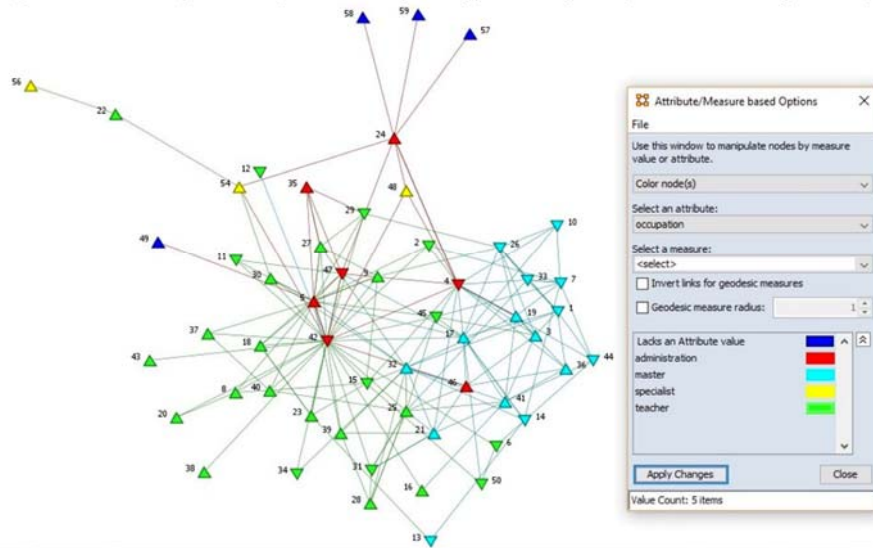


Figure 1: Sociogram (work-related). "Who do you ask for professional help among your colleagues?"

It is important to mention that communication structure for working relations is quite tight, especially for the 1st question. The critical element of the structure linking separated groups is administration, which is represented by red colour. Particular attention should be paid to numbers 42 and 47, who are at the centre of each structure. Comparing the structure of working communications among teachers (green colour) and masters (blue colour), the second ones have more close relations with each other. Also, in the picture, it is possible to notice elements situated far away from others (isolates). It means that some employees are away from the collective and doesn't support the relations with colleagues.

Question 6. "Who do you trust most of all among your colleagues?" (Indicator of trust)

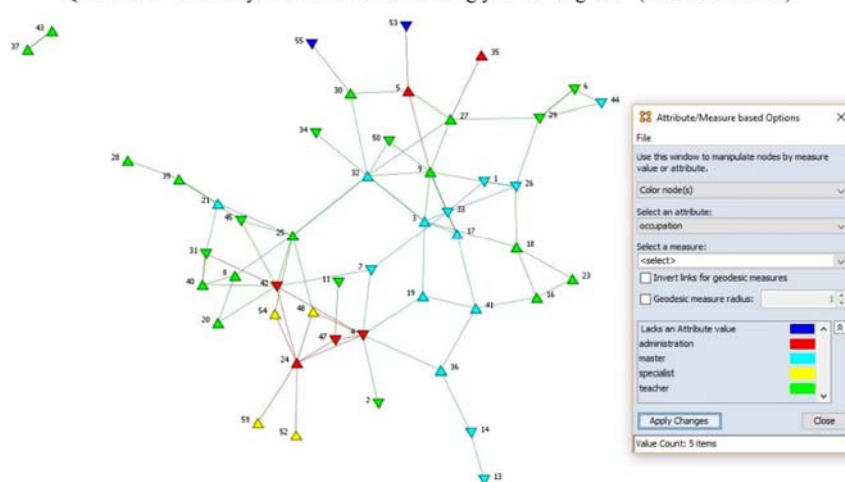


Figure 2: Sociogram (trust-related). "Who do you trust the most of all among your colleagues?"

The second sociogram (Figure 2) shows much fewer links between employees, which mean that employees trust only a few people. Moreover, groups are smaller and more distant from each other. However, masters continue to appear more integrated group than subject teachers.

We calculated degree and centrality scores to measure communication structure on sociograms for each question. The descriptive statistics on these items is in Table 7.

Table 7: Descriptive statistics on informal communication degree and centrality indices

Indicator	Average	Median	Standard deviation	Minimum	Maximum	Number of observations
WORK-RELATED "Whom do you ask for professional help from your colleagues?"						
Betweenness	.0210709	.0027101	.0335784	0	.1343756	40
In-degree	.0508475	.0169492	.0812049	0	.4237288	45
Out-degree	.0794727	.0847458	.0310478	.0169492	.1355932	45
TRUST-RELATED «Who do you trust the most of all among your colleagues?»						
Betweenness	.0133617	.0064815	.0204784	0	.090404	38
In-degree	.0318182	.0181818	.0307427	0	.1090909	40
Out-degree	.0563636	.0545455	.0281672	.0181818	.1454545	40

4.4 Exploring the relationship between informal communication and satisfaction/loyalty

We use multivariate linear regression with control variables to explore the nature and the features of the relationship between informal communication structure indices and satisfaction indices and level of loyalty. Sex and position were recoded to binary variables to control the effect. Models including in and out-degree indices were not statistically significant. So we included the model summary and fit statistics only for valid models in this article (Table 8).

Table 8: Model statistics and fit

Dependent variables	WORK RELATIONSHIP (question 1)		TRUST RELATIONSHIP (question 6)					
	Administration (model 1)		NPS (model 2)		Overall attitude (model 3)		Colleagues (model 4)	
	N = 40	VIF	N = 39	VIF	N = 39	VIF	N = 39	VIF
<i>Standardized regression coefficients and VIF</i>								
Betweenness centrality	0.587***	2.17	-(.347)**	1.39	-(.062)*	1.39	-(.239)*	1.39
Sex (male)	0.114	1.11	-(.038)	1.11	-(.011)	1.11	-(.099)	1.11
Position (master)	0.472*	4.41	-(.157)	2.51	.006	2.51	-(.247)	2.51
Position (teacher)	0.623*	5.66	-(.278)	2.56	-(.015)	2.56	-(.190)	2.56
Years in College	0.519***	1.35	.407**	1.42	.956***	1.42	.684***	1.42
Income level	-.347**	1.45	.318*	1.28	.133***	1.28	.342***	1.28
Constant	4.793***	-	6.736***	-	1.978***	-	4.271***	-
<i>Model Fit statistics</i>								
	Model 1		Model 2		Model 3		Model 4	
R square	.344		.329		.974		.611	
Adj. R square	.225		.203		.969		.538	
F	2.89**		2.62**		201.15***		8.36***	
Assumptions break	NONE		Heteroskedasticity		NONE		NONE	

* p <.10, **p <.05, ***p<.01

We checked the set of assumptions to assess the explanatory power and significance of the model. These assumptions were Homoskedasticity: (Breusch-Pagan test), Multicollinearity (Variance inflation rate – VIF), No omitted variables (Ramsey RESET test), Normal distribution of residuals (Durbin-Watson test). All models except for model 2 have no assumption breaks. Data distribution in model 2 is heteroscedastic.

The interpretation of the model coefficients is the following:

1) *Model 2*. The higher the level of work relationship involvement (betweenness), the higher employees are satisfied with the administration of College. According to the value of standardised regression coefficient, the betweenness is as important as experience in College to predict satisfaction about the administration. Work experience and position effects are also present and statistically significant, whereas gender effect is not.

2) *Model 2-4*. The higher the level of trust relationship involvement (betweenness), the lower the NPS, overall satisfaction with colleagues, attitude towards college. Work experience and income level effects are also present and statistically significant. We notice that the sign of the relationship between informal communication structure and satisfaction/loyalty changes once we change the nature of the relationship from work (question 1) to trust (question 6). We call this effect satisfaction hypocrisy. Employees are less satisfied/loyal to the college, colleagues and superiors if they keep trust-related communication in mind. Moreover, on the contrary, employees are more satisfied with superiors if they discuss work-related communication.

3) Work experience (amount of years in College) has the significant effect on different loyalty measures in all models. Model 3 has the best explanatory power, R square equals 97,4%. Work experience plays the most valuable role in predicting overall attitude towards College and employees (colleagues).

4) Trust relationship (questions) are more suitable to measure the relationship with the loyalty indices in comparison with work-related communication.

5 Conclusion

The of the existence of the relationship between employee's loyalty and informal communication structure was confirmed. Male employees appeared to be more loyal. Employees of the low-income group show unwillingness to recommend the College. People of low income show the strong relationship between loyalty and satisfaction with their further opportunities and perspectives. The loyalty and the level of a density of the group depend on the experience of a person within the College. Thus, those, who are working for 6 and more years are together in the social groups and tend to be most loyal and satisfied, while those, who are working from 2 to 5 years are scattered on the sociogram and show the lowest loyalty.

Masters appeared to be the most loyal group, which is traced through their NPS index and the number of years working within the company. The list of factors which they are satisfied with at work is the longest among other groups, as they admire all employees (peers and superiors), they positively evaluate job itself, its perspectives and ways to develop and they are satisfied with the way others perform their job. There is a strong correlation between loyalty and their degree of centrality within the group. Therefore, the connection the research was aimed to exists, and it is even stronger in the case of masters. Their grouping is the tightest, and their loyalty is the highest.

Administrators (superiors) are commonly located in the centre, their attitude towards the College differ notably. Their centrality level is high. However, some of them are "Detractors", so that in their case there is no connection between their social ties and loyalty.

Teacher's do not have a stable informal communication structure. Moreover, the results of their correlation check did not reveal any statistically significant connection between their loyalty and centrality index.

To sum up, the process of identifying the connection between loyalty and informal communication structure resulted in confirming the existence of the relation, but only for "Promoters", or loyal members of the College. Those, who are the most loyal, are the part of a tightest informal social groups. As they are the most loyal, they are at the same extent satisfied, reflecting the highest rates for different factors of the working environment.

However, there exist several threats to the validity of the research both internal and external. As to the internal validity, it is possible to name such risks as mortality, testing and diffusion of treatment. Thus we pay attention to holding questionnaires individually and try to explain the importance and usefulness of this research for the employees. Moreover, employees' answers could differ from their opinion in case they were afraid of consequences. However, our research guaranteed anonymous and access to data only to the researchers.

Also, several threats to the external validity of the population could appear. Firstly, the interaction of selection and treatment, as far as the studied unit covers only teaching staff, therefore, the results could hardly be applied to overall loyalty and informal communication structure. One more threat is the interaction of history and treatment, which appear due to changing environment and working staff of the college, so that when sometime later the results may change. Finally, the study could hardly be generalised as loyalty, factors of satisfaction and informal communication structure vary in different organisations.

References

- Allen, G.S., Attner, R.F. & Plunkett, W.R. (2007). *Management journal*: Cincinnati, OH, SouthWestern Publication.
- Behrend, F. D., Erwee, R. (2009) Mapping knowledge flows in virtual teams with SNA. *Journal of Knowledge Management*, 13 (4), 99-114.
- Girvan, M., Newman, M. (2002). Community structure in social and biological networks. *PNAS*, 99 (12), 7821–7826.
- Guillon, O., Cezanne, C. (2014). Employee loyalty and organisational performance: a critical survey. *Journal of Organizational Change Management*, 27(5), 839-850.
- Hackman R.J., Oldham R.G (1975). Development of the Job Diagnostic Survey // *Journal Of Applied Psychology*. 1975. V. 60. P. 159–170.
- Freeman, Linton (1977). "A set of measures of centrality based on betweenness". *Sociometry*. 40, 35–41
- Hajdin, M. (2005). Employee Loyalty: An Examination. *Journal of Business Ethics*, 59(3), 259-280.

- Hanneman, R.A. (2001). Introduction to Social Network Methods, *Department of Sociology, University of California, Riverside, CA*.
- Harsky, K. V. (2003). Trustworthiness of staff. *Saint-Petersburg, Russia: Piter*.
- Harter, J.K., Schmidt, F.L. & Hayes, T.L. (2002). Business-unit-level relationship between employee satisfaction, employee engagement and business outcomes: A meta-analysis. *Journal of Applied Psychology, 87*(2), 268-279.
- Hitt, M.A., Tihanyi, L., Miller, T. & Connelly, B. (2006). International diversification: antecedents, outcomes, and moderators. *Journal of Management, 6*, 831–867.
- Lawson, et al. (2009). Knowledge Sharing in Interorganizational Product Development Teams: The Effect of Formal and Informal Socialization Mechanism. *International Journal of Product Innovation Management, 26*, 156–172.
- Mehta, S., Singh, T., Bhakar, S.S., Sinha B. (2010). Employee Loyalty towards Organization – A study of Academician. *International Journal of Bussiness Management. Economic Research, 1*(1), 98-108.
- Moreno, Jacob L. (1951). Sociometry, Experimental Method, and the Science of Society. *Ambler, PA: Beacon House*.
- Ruck, K., Welch, M. (2012). Valuing internal communication: management and employee perspective. *Exploring Internal Communication, 294-302*.
- Schrag, B. (2001). The Moral Significance of Employee Loyalty. *Business Ethics Quarterly, 11*(1), 41-66.
- Tamer, A., Suhaila, E., (2012). Assessing the effect of interpersonal communications on employees' commitment and satisfaction. *International Journal of Islamic and Middle Eastern Finance and Management, 5*(2), 134–156
- Wang H., Zhao J., Li Y., Li C. (2015) Network centrality, organizational innovation, and performance: A meta-analysis. *Canadian Journal of Administrative Sciences, 32*,146–159.
- Wasserman, S. & Faust, K. (1994) Social Network Analysis. *Cambridge Univ.Press, Cambridge, U.K.*
- Yashkina, P.V., Sklyar, E.N. (2012) Metodiki ocenki loyal'nosti potrebitelej. Ispol'zovanie nps-metoda pri analize klientskoj loyal'nosti. *Marketing i marketingovye issledovaniya, 1*, 28-40.
- Yee, R., Yeung A. & Cheng E. (2010). An empirical study of employee loyalty, service quality and firm performance in the service industry. *International Journal of Production Economics, 124*(1), 109-120.

Gaming in Education, Scientific and Market Research and Business Activity

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The role of gamification – which may be defined as the use of game elements in non-game context – is expected to increase over the next years within a variety areas of application, such as learning and assessment, scientific and market research, promotion or business operations, etc. Its potential is related to, among others, the rise of new needs with the entering the labor market by the Y generation. The common purpose of gamification is to enhance one's motivation (eg. students, employees, job candidates) and engagement in certain activities. Gamification is also an effective tool to help in problem solving which is also used as a support in research. Papers in this stream aim at deepening a contemporary understanding of gamification with a focus on (higher) education in particular and the role of gamification as a tool in scientific and market research, marketing, and business activity. They also focus on identification and assessment of the opportunities and challenges of gamification.

Negotiations in strategic economic games – challenges for developing an artificial intelligence engine

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Abstract: The aim of the paper is twofold: 1) to assess the existing engine mechanisms and quality of negotiations in strategic economic games within Player-NPC interactions by determining the gap in delivering realistic gameplay, and 2) to propose a design of an multi-agent system based on artificial intelligence providing a new quality of negotiations in strategy games – more realistic, ie. replicating behaviour of “live” players, enhancing the useability of the game (satisfaction of the human player in the single player game). For this purpose, an in-depth analysis of the literature on the subject and evaluation of the applicability of multi-agent systems and AI techniques, such as artificial neural networks, Monte Carlo tree search (MCTS), reinforcement learning (Q-learning) or fuzzy logic will be carried out in order to develop a framework that suport machine learning model. As a result we obtain a model of interactions between agents (modules) in strategic economic games, being intelligent multi-agent system, that are more realistic by replicating behaviour of human players within Player-NPC interactions and reproducing the complexity of the relationships that occur in socioeconomic systems – according to the paradigms of modern economic systems that increases the complexity of economic processes.

Keywords: realistic gameplay, negotiations, economic strategy games, AI engine, multi-agents system

1 Introduction

In this paper we present the assumptions and theoretical base of the project within Sectoral Programme GameINN (supported by the National Centre for Research and Development in Poland) which is aimed in designing and implementing an artificial intelligence engine that delivers realistic gameplay in economic strategy games - MAS4SEG (Multi-Agent System for Strategic Economic Games). Thus the aim of the paper is twofold: 1) to assess the existing engine mechanisms and quality of negotiations in strategic economic games within Player-NPC interactions by determining the gap in delivering realistic gameplay, and 2) to propose a design of an multi-agent system based on artificial intelligence providing a new quality of negotiations in strategy games – more realistic, ie. replicating behaviour of “live” players, enhancing the useability of the game (satisfaction of the human player in the single player game).

The project will effect in product innovation, ie. an economic strategy game using the artificial intelligence mechanism – in particular: a library (AI engine) for broader class of economic strategy games as well as a game using the above mentioned library, and server application with analytical module for data collecting and further improvents of the AI.

Based on the overview of the solutions on the market of computer games regarding the functioning of the negotiation mechanism in strategic economic games, confronted with the assessment and perception of their functionality and usefulness by players, a game engine mechanism will be proposed that eliminates the main weakness of economic strategic games on the market in the area of negotiation mechanisms in game play. For this purpose, an in-depth analysis of the literature on the subject and evaluation of the applicability of multi-agent systems and AI techniques, such as artificial neural networks, Monte Carlo tree search (MCTS), reinforcement learning (Q-learning) or fuzzy logic will be carried out in order to develop a framework that suport machine learning model.

The study is focused on artificial intelligence methods and optimisation of utility function within decision process of player in gameplay as interactive computer games are an opportunity area for exploring techniques and theories leading to human-level AI. As a result we obtain a model of interactions between agents (modules) in strategic economic games, being intelligent multi-agent system, that are more realistic by replicating behaviour of human players within Player-NPC interactions and reproducing the complexity of the relationships that occur in socioeconomic systems – according to the paradigms of modern economic systems that increases the complexity of economic processes.

The rest of the paper is organised as follows. Section 2 provides an overview of the literature on designing algorithms for strategic economic games underlying the challenging issues. In section 3 we give a special importance to multi-agents systems and AI techniques as framework for computer game engine. Section 4 describes negotiations in strategic economic games including the structure and relationships between modules of AI engine for Multi-Agent System for Strategic Economic Games (MAS4SEG) proposed in the project.

2 Challenges in designing algorithms for strategic economic games

Current game worlds are visually rich but information poor – particularly poor from the artificial intelligence (AI) point of view (González-Calero & Gómez-Martín, 2011). This problem of a lack of rich information suitable for consumption by the game AI often limits the true potential for deeper levels of interaction that are becoming more in-demand by game players. So, the challenge is to improve the embedded information contained in immersive game worlds. Using tools to incorporate information into the game design and development process can help create information-rich interactive worlds. AI developers can work with these environmental information elements to improve non-player character (NPC) interactions both with the player and the environment, enhancing interaction, and leading to new possibilities such as meaningful in-game learning (González-Calero & Gómez-Martín, 2011). Interactive computer games are an opportunity area for exploring techniques and theories leading to human-level AI. One of the key problems in our current information-poor virtual worlds is that

the playing field is clearly not level for AI characters (NPCs), especially when competing with humans in the same space. Hence, in practice game AI is often implemented with a level of cheating such as using perfect information (ie., complete world knowledge) (González-Calero & Gómez-Martín 2011, p. 35).

Making interaction of agents (modules) and gameplay in strategic economic games more realistic is a challenge that involves reproducing the complexity of the relationships that occur in socioeconomic systems (Lorek, 2012). At the same time, the paradigms of modern economic systems increase the complexity of economic processes, creating challenges for the realistic gameplay in strategic economic games. One of them is inclusion of changes in relative prices of individual goods and their production costs to the game that significantly increase the dynamics of areas' usability in terms of strategic (temporalspatial value of particular areas on the map). Enabling artificial intelligence to properly "understand" the map requires the use of spatial econometric methods, whereby the AI will be able to determine the value of areas both in terms of their strategic location (including neighborhood) and non-deterministic changes in time values as a result of price changes and production costs. Correct definition of the values of areas on the map will also allow NPCs to conduct more realist commercial and diplomatic negotiations on strategic issues, especially after adding the possibility to use negotiation and sales techniques into the negotiations.

In such a case, the relationships between particular economic variables are generally not clearly defined (eg linear or exponential), and this fact justifies the use of neural networks and other artificial intelligence methods in social and economic applications because of the features of neural networks such as generalization and adaptability. This key aspect of the successful application of neural networks in decision optimization is the proper selection of input variables, which is generally associated with long-lasting and tedious tasks (Lorek, 2012).

In contemporary video games algorithms are often complex, their implementation time consuming, and there is little or no room for learning (Meier, Biedron, LeBlanc & Morgan, 2011). This makes a game entertaining only until the player can anticipate the agents' behavior. To overcome this, Stanley et. al (2005) have developed agents that can learn from their interactions with the player during the game. In this approach, each agent is controlled by an artificial neural network (ANN), whose structure evolves through time. Before the ANN can operate, it must be trained for a given task. Conventional training methods such as the back-propagation algorithm only act on the weights of the ANN, without adjusting the connections and the number of nodes. However, these elements play an important role in the success of ANN and it is where the method known as Neuro-Evolution of Augmenting Topologies (NEAT) becomes of interest (Stanley & Miikkulainen, 2002). This technique has been successful at evolving the whole structure of ANN-based game agents.

The agents in the video game NERO were capable of learning online while the game was being played, the skills of the agents were evolved gradually (Wong & Fang, 2012). The neuroscientific approach provides an answer to some important questions about the effectiveness of the development of artificial neural networks through evolution. Solutions to the major challenges of evolutionary neural network development include NEAT. In NEAT networks evolutionary algorithms seek the values of neural network weights and develop a

network topology - from the simplest of the initial structure to the specialized complex structure adapted to the problem that is to be solved.

One of the important issues to apply intelligent multi agent systems in virtual environment is to develop a framework that support machine learning model to reflect the whole complexity of the real world (Asadi, Mustapha & Sulaiman, 2009). In order to solve the gap between two applicable flows of intelligent multi-agent technology and learning model from real environment is a framework of intelligent agents based on neural network classification model – Supervised Multi-layers Feed Forward Neural Network (SMFFNN).

All games of perfect information have an optimal value function which determines the outcome of the game, from every state, under perfect play by all players. These games may be solved by recursively computing the optimal value function in a search tree (Silver et al., 2016). Monte Carlo Tree Search (MCTS) (Coulom, 2006, Kocsis & Szepesvári, 2006) uses Monte Carlo rollouts to estimate the value of each state in a search tree. As more simulations are executed, the search tree grows larger and the relevant values become more accurate. The policy used to select actions during search is also improved over time, by selecting children with higher values. Asymptotically, this policy converges to optimal play, and the evaluations converge to the optimal value function (Kocsis & Szepesvári, 2006).

The key to decision making using utility-based AI is to calculate a utility score for every action the AI agent can take and then choose the action with the highest score (Graham, 2013). Provided a reasonable scoring system, utility-based AI is very good at making a “best guess” based on incomplete information.

Behavior trees, within many methods and approaches for creating AI for games, have emerged as a recent competitor, combining features of final-state machines and hierarchical task networks. As the available computational powers increase, the feasibility of using evolutionary computations in the development of game AI rises (Christensen & Hoff, 2016).

In more complex strategic games, especially with imperfect information, the above methods require too much computation time, so a challenging task is to reduce the information needed to calculate the value function. In the presented project we will divide the space of variables into smaller subsystems – functional modules of the game. Each module will be an agent with its own AI engine (eg. based on MCTS or/and ANN and/or Utility AI and/or behaviour trees) and will cooperate with other agents (other modules) in order to achieve a joint value function.

3 Multi-agents systems and AI techniques as framework for computer game engine

While there has been quite a lot of research into various artificial intelligence methods, the primary focus of much of this research is concentrated on single-agent systems, or in larger systems with multiple independent agents (Franklin & Markley, 2013). Our focus is on multi-agent systems where the team is coordinating its actions guided by some larger strategy.

On the other hand, most research on algorithms for games has focused on zero-sum games, such as Chess, Checkers and Go. This is not perfectly suitable for strategic games, especially economic ones as the whole idea of a market economy is essentially a non-zero sum game; each participant in the economy has its own personal goals and by exchanging goods and services with one another each individual participant may benefit. Additionally, while multi-agent research does not currently go so far as to begin to form strategic reasoning, we wish to show that it can. Strategic reasoning arises when the team of intelligent agents uses the available information in a way that exhibits a collective intelligence. In the case of MAS4SEG proposed in the described project all agents, representing functional modules of an economic strategic game create a cooperating system (coordinating their actions and sharing information) working to achieve a profitable deals in diplomatic actions against other players (NPCs and humans).

The field of Automated Negotiations is an important field of research within Artificial Intelligence. The domains investigated in Automated Negotiations, however, are often of a much simpler nature than traditional games. One usually assumes that the negotiators make proposals for which the exact utility values can be determined quickly (Baarslag et al., 2010).

Economic problems are very complex as there are many actors involved (the state, producers, customers, NGOs etc.). Multi agent systems deal with such problems very well because of: 1) non-hierarchical, distributed system, 2) problem solving parallelization, 3) collective intelligence (shared knowledge), 4) more resistant to outliers.

Little attention has been given to negotiation settings in which determining the utility value of a deal is itself a hard problem. The preferences of the agent's opponents on the other hand, are often assumed to be completely unknown. This is in sharp contrast to Game Theory, in which reasoning about one's own utility and the opponent's utility is paramount. Furthermore, one usually assumes the negotiation algorithms do not require any domain knowledge or reasoning at all, or that all such knowledge is hardcoded in the algorithm (de Jonge & Zhang, 2017).

In order for the agents to be able to take their actions in a distributed fashion, appropriate coordination mechanisms must be additionally developed. Coordination can be regarded as the process by which the individual decisions of the agents result in good joint decisions for the group. Coordination via communication is seen as an advantageous manner with algorithms that are based on the so-called social conventions, role assignment and variable elimination in order to diminish the equilibrium computation time and effort.

4 Negotiations in strategic economic games

The main problem of AI engines of existing strategic games, which is visible to players, is related to negotiations of peace and business deals that is a must-be feature in every strategic games. It can be found in many different forums and industry studies that diplomacy is the main weakness of strategic games. Some examples of citations found on different websites to support this thesis are as follows: "The Frustration of Civilization VI's Diplomacy...",

“Civilization 6 UI and diplomacy flaws”, “Civilization 6 expansions must fix these 3 things about the game: diplomacy, religion, tourism”, “5 Times Civilization 6's Diplomacy AI Proved To Be Absolutely Terrible”, “Diplomacy is Something Awful: Europa Universalis IV”, “War and diplomacy mechanics are... disappointing? : Stellaris”, “AI Diplomacy Nearly Impossible: Stellaris”, “There is no diplomacy in Total War games”, “I don't understand the diplomatic part of Total War...”.

Arguably the best-known example of a complex game that does involve negotiations is the game of Diplomacy (Fabregues & Sierra, 2011). A number of negotiating agents have been developed for this game, but they highly depend on details specific for Diplomacy and are therefore hard to generalize to other settings, although recently a new interest in Diplomacy as a test-bed for negotiations has sparked with the introduction of the DipGame framework (Fabregues & Sierra, 2011) for the development of Diplomacy agents for scientific research. Several negotiating Diplomacy players have been developed on this platform (Ferreira et al., 2015, Finnsson, 2012, Fabregues, 2012, de Jonge, 2015).

Negotiation is the focus of a great deal of research, both within the traditional business and conflict resolution literatures, and (more recently) in artificial intelligence. Negotiation - in the computational sense - tends to be researched in one of two broad paths. Agent-agent negotiation focuses on distributed problem solving and computational efficiency, as perfectly rational agents can quickly exchange thousands of offers in order to solve large problems. Human-agent negotiation offers separate challenges, as all agent designs must be subject to empirical evaluation and testing in the field. Human-agent negotiation also tends to be much slower than agent-agent negotiation, and may involve additional channels of communication—emotional exchange, free chat, and preference statements in addition to offer exchanges. All of these features are necessary for a human-agent system that attempts to simulate the often free-wheeling style of interaction that characterizes human-human negotiation. The human-agent interactions is a relatively new direction in AI research (Mell, & Gratch, 2017).

One classical option for investigating human-agent negotiation takes the form of the multi-issue bargaining task, which is considered a *de facto* standard problem for research into social cognition and interpersonal skill training (Van Kleef et al., 2004). In the multi-issue bargaining task, two participants work to determine how to split varying issues, each with hidden values to each side. The task may involve distinct phases, where first information about preferences is exchanged, and then a series of offers are made. The task is also often characterized by time pressure, which is often modeled as a decaying utility function. Even with a small number of issues, the task can quickly become a challenge for agents to simulate, especially those which aim to act as partners for humans in such a negotiation in real time, and numerous works attempt to address the multi-issue bargaining task (Faratin et al., 2001, Fatima et al., 2007, Kraus, 2001, Robu et al., 2005). While this makes the multi-issue bargaining task a difficult challenge computationally, adding a human actor complicates issues even further, since humans often behave “irrationally” in game theoretic contexts.

Many negotiation research foci attempt to simplify the problem by making protocols that strongly limit what information can be exchanged. They often model information exchange as

a costly endeavor by which every instance of interchange is modeled by a set “price” that reduces endgame utility values, (more commonly) refuse to allow information exchange at all, instead preferring to model opponent preferences using stochastic processes (Baarslag & Hindriks, 2013). Other attempts require offers to alternate from one side or another, or specify that only full offers, wherein no items are left undecided, can be exchanged. While these solutions allow for progress in limited human-agent contexts, and certainly have their benefits in agent-agent negotiation, they hardly resemble the freeform nature of actual human-human negotiation.

Therefore, our project is motivated by an attempt to design agents that can practically negotiate with humans. Agents, like humans, should make use of similar channels of communication, such as emotional exchange, preference utterances, and partial offer exchange. These agents should use human techniques, likes the exchange of informal favors (Mell et al., 2015), or the use of anger in negotiation to secure value (de Melo et al., 2011). Ideally, agents should be able to build trust over time with repeated negotiations, and should recognize past betrayals and alliances. These features are key to solving age-old negotiation challenges, such as what Kelley calls the “dilemma of trust” and the “dilemma of honesty” (Kelley, 1966, Yang et al., 2014). However, there exists no platform upon which these challenges may be readily explored in the human-agent interaction context (Mell & Gratch, 2017).

While humans often treat agents differently than their human counterparts or even human-controlled avatars (agents are often subject to outgroup effects) (Blascovich, 2002, Fox et al, 2015), virtual agents that exhibit human-like features such as emotion or natural language are often treated in a near-human way. To that end, a system of hosting negotiations between agents and humans must needs have the ability to manipulate channels of communication used by humans.

Previous efforts to allow for effective human-agent negotiation include the multi-issue bargaining task game, Colored Trails (Gal et al., 2005, Peled et al., 2011), its web-based cousin WebCT (Mell et al., 2015), as well more natural-language focused approaches such as NegoChat (Rosenfeld, 2014). However, these solutions tend to focus solely on communication. They are single-agent solutions and none of them include any kind of game environment in which decisions other than strictly related to negotiations can be made (eg. regarding production, development or warmongering).

In the proposed project human-agent negotiations will be based on information coming from the game environment and other agents in the case of NPC negotiator. As there will be a vast space of decision states in which an NPC negotiator will need to form a utility value much data will be needed to feed the AI of diplomacy agent. The data collected in this stage of the project (from laboratory tests) will form a base that will be built upon in the next phase of the project. Nonetheless a challenge is to develop a functional cloud computing (analytical) server application that intercepts real-time data from all test games, archiving collected information. The server application must be linked to the AI engine of the game being tested, and during the testing process, server communication must be maintained continuously for each test game to provide constant data transfer and data feeding.

Traditionally, game producers heavily rely on game testers, who are primarily responsible for analyzing computer games, finding software defects and being a part of quality control process, to achieve this goal. But, it is not often reliable (Chen & Chang, 2013). To ensure the investment can be returned, game producers need an effective approach to discover frequently shifted customer preferences in time. Thus, recently, Kano model and data mining techniques have been successfully applied to recognize customers' preferences and implement customer relationship management tasks, respectively. However, in traditional Kano analysis, only basically statistical analysis techniques are used, and they are insufficient to provide advanced knowledge to enterprisers. Therefore, in order to discover the relationship between/among quality elements in Kano model and to extract knowledge related to customer preferences, Chen and Chang (2013) proposed a knowledge acquisition scheme that integrates several data mining techniques including association rule discovery, decision tree, and self-organizing map neural network, into traditional Kano model.

The novelty of AI engine in this project relates to use a multi-agent system (MAS) design to provide a new quality of negotiations (diplomacy) in strategic games. The system will work on several levels including both agent-agent and human-agent communication. First of all, as negotiation is primarily related to economy and business, the AI engine must understand well economic and management issues. An entity which will face human players (eg. a country, or a nation) was divided into 7 functional economic modules which will operate as individual agents jointly aiming at obtaining best deals from counterparts of their team (eg. country, nation). These agents will be responsible for: 1) diplomacy, 2) investments, 3) microeconomic issues, 4) macroeconomic issues, 5) social policy, 6) spatial interdependences, and 7) military actions. Acting cooperatively the agents will face other nations (led by humans or NPCs) and self-interested agent-agent or human-agent negotiations will take place to conclude trade exchanges or peace negotiations (see scheme on Figure 1).

This allows division of the space of variables into smaller subsystems – functional modules of the game. Each module will be an agent with its own AI engine (eg. based on Monte Carlo Tree Search or/and Artificial Neural Networks and/or Utility AI and/or behaviour trees) and will cooperate with other agents (other modules) in order to achieve a joint value function.

The feature of diplomacy module is conducting trade and peace negotiations, etc., in particular developing the NPC strategy during the trade negotiations by introducing the possibility of using NPC techniques by players and negotiators. The spatial module is responsible for “understanding” of the map by the AI mechanism, ie., the values (utility) of its individual areas in the neighbourhood context using the spatial econometrics method with the changes in usefulness of these areas in terms of strategic (long-term) benefits. This will improve the NPC's decision during the negotiations. The next one, macroeconomic module, was set in order to “understand” the economy managed by the AI mechanism, in particular the impact of economic policy instruments on trade relations, main economic aggregates (GDP components), inflation and unemployment, exchange rates in the uncertain macroeconomic environment (macroeconomic risks). Microeconomic module's feature is the ability to assess the profitability of AI actions in relation to changing market conditions (demand and supply volatility for particular stocks/products created in the game and

consequently price volatility, currency volatility, wage levels, etc.) under microeconomic uncertainty (microeconomic risks). As far as investment module is concerned the functionality is based on the ability of the AI mechanism to determine the expected value and investment planning (development of production capacities of provinces, enterprises) under macro- and microeconomic risks. The role of social module is “understanding” by the AI the mechanism of the impact of economic policy and tools that motivate employees on the social sentiment in a NPC-managed unit (state, enterprise). The feature of military module is the ability of AI to set long-term strategic military objectives (at strategic level) and to anticipate potential military objectives for the player to implement counter-measures.

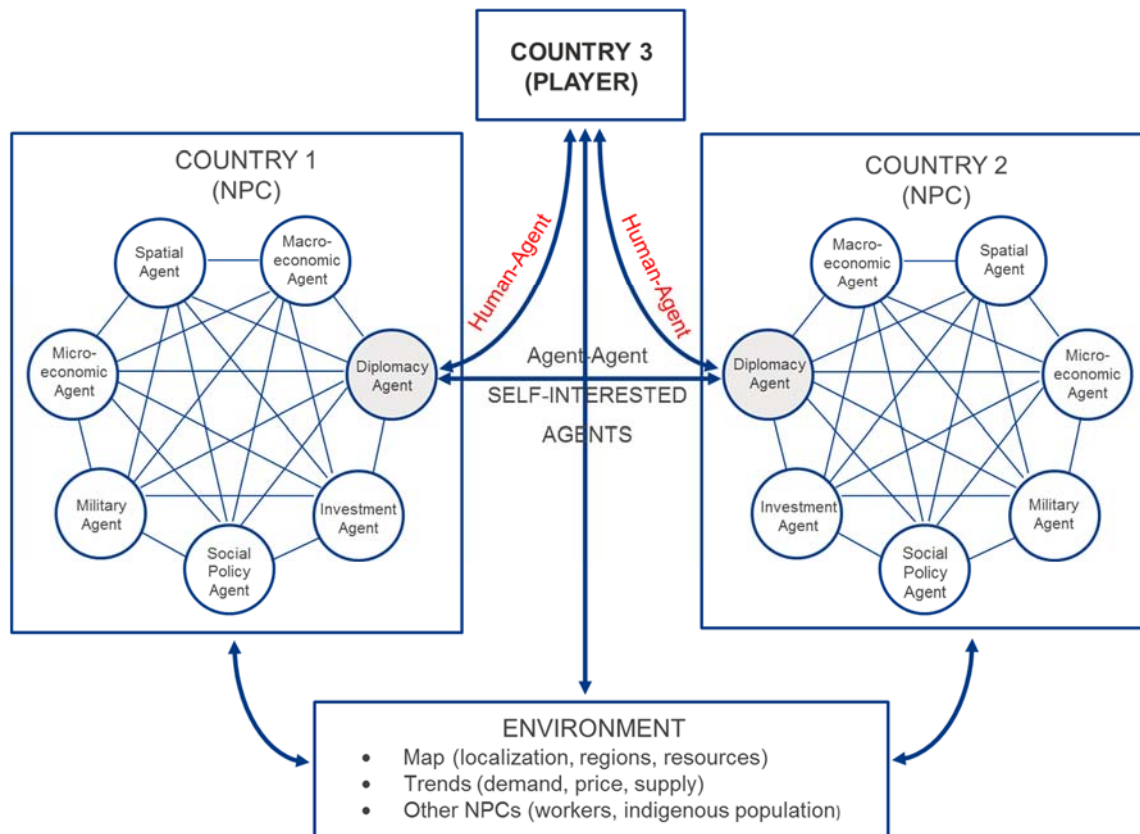


Figure 1: The structure and relationship between modules of AI engine for strategic economic game

AI mechanism is the solution which, in a more realistic way than in existing strategic games, conducts trade negotiations and peace negotiations, and “understands” the world over the long term, “understands” the map in the context of neighborhood (spatial module) which predicts the changes in the usefulness of areas in strategic terms, capable of being adapted to changing conditions (operating under uncertainty).

5 Conclusions and further research

The design of this AI engine based on multi-agent system approach enables to deliver in practice more realistic AI behavior in strategic economic games. It responds to the main problem of AI engines of existing strategic games that is a must-be feature.

The innovation in this project is linked to the AI mechanism which, using much deeper understanding of game economics, will improve negotiations and provide a realistic gameplay in economic strategic games, by extending the scope of player interaction with NPCs in strategic games - both in terms of range (new areas of interaction for previously neglected economic aspects such as negotiation techniques (both player and NPC)), quantity (increasing the scope and variety of trade agreements) and time (AI mechanism will extend the perspective and decision-making potential of NPCs from short-term to long-term, strategic).

We can distinguish some key features of the designed artificial intelligence. The first one is a more realistic (human/replicating behavior of "live" players) AI behavior in strategic games, enhancing the usability of the game, ie. satisfaction of the "living" player in the single player game. This will be obtain among others by the AI "strategic thinking" in strategic games (i.e. anticipation over time and taking into account the change in the value of resources over time - and not only short-wave and not considering both the environment, as well as the interdependence of phenomena in time and space, as done in the past solutions) – which is not observable now in the strategic games on the current market. Another key feature is a higher degree of complexity of AI engine that makes the NPC operations more real, as well as expansion of economic aspects of the game (such as negotiation or price volatility) to achieve the effect of more realistic AI in strategic games. Finally the extension of the scope of player interaction with the NPC should be pointed out to describe designed AI.

Differences in project results in comparison with existing solutions are as follows:

1. AI mechanism which conducts trade and peace negotiations in a more realistic way than in existing strategic games, as well as "understands" the world in the long run, "understanding" the map in the context of areas neighborhood, which predicts the changes in strategic usability of the area, and is able to adapt to changing conditions (operating under uncertainty).
2. Extension in comparison to existing solutions in the economic sphere and management in strategic games. In today's emerging markets, the computer only makes simplistic negotiations (in the scope of areas with a little importance from the perspective of the whole game, such as the evaluation of the current resources value). Meanwhile, there is a need for allowing negotiation about strategic issues - important and complex, with long-term consequences.

For this, it is necessary to include in AI engine some additional functionalities (in relation to existing solutions) in the form of economic and management elements, in particular the spatial module, and to teach the NPC the importance of neighborhood and spatial interdependence in relation to specific areas of the game map - currently there is no such solution; there is a lack of spatial econometric elements in AI algorithms.

In addition, in order to make negotiations (strategic or commercial) in strategic games more realistic, it is important to include a time factor and the need to anticipate changes in the value of resources, teaching the AI the prediction of a change in area utility in strategic terms. At the same time, the behavior of the external environment (e.g. price changes) must be included in the modeling of NPC behavior - teaching AI to adapt to changing conditions (operating in uncertain conditions).

References

- Asadi, R., Mustapha, N., & Sulaiman, N. (2009). A Framework For Intelligent Multi Agent System Based Neural Network Classification Model. *International Journal of Computer Science and Information Security*, 5(1), 168-174.
- Baarslag, T., & Hindriks, K. V. (2013, May). Accepting optimally in automated negotiation with incomplete information. In *Proceedings of the 2013 international conference on Autonomous agents and multi-agent systems* (pp. 715-722). International Foundation for Autonomous Agents and Multiagent Systems.
- Baarslag, T., Hindriks, K., Jonker, C. M., Kraus, S., & Lin, R. (2010). The first automated negotiating agents competition (ANAC 2010). In T. Ito, M. Zhang, V. Robu, S. Fatima, & T. Matsuo (Eds.). *New Trends in Agent-based Complex Automated Negotiations*, Series of Studies in Computational Intelligence (pp. 113–135). Berlin, Heidelberg: Springer-Verlag.
- Blascovich, J. (2002). Social influence within immersive virtual environments. In *The social life of avatars* (pp. 127-145). London: Springer.
- Chen, L-S., & Chang, P-Ch. (2013). Extracting knowledge of customers' preferences in massively multiplayer online role playing games. *Neural Comput & Applic*, 23, 1787–1799. DOI 10.1007/s00521-012-1145-5.
- Christensen, H. J., & Hoff, J. W. (2016). Evolving Behaviour Trees: Automatic Generation of AI Opponents for Real-Time Strategy Games. Master thesis. Norwegian University of Science and Technology.
- Coulom, R. (2006). *Efficient Selectivity and Backup Operators in Monte-Carlo Tree Search*. In Proc. 5th Int. Conf. Comput. And Games, Turin, Italy, 72–83.
- de Jonge, D. (2015). Negotiations over Large Agreement Spaces. PhD thesis, Universitat Autònoma de Barcelona, 2015.
- de Jonge, D., & Zhang, D. (2017). Automated Negotiations for General Game Playing. In S. Das, E. Durfee, K. Larson, & M. Winikoff (Eds.), *Proceedings of the 16th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2017)*, May 8–12, 2017, São Paulo, Brazil.
- de Melo, C. M., Carnevale, P., & Gratch, J. (2011, May). The effect of expression of anger and happiness in computer agents on negotiations with humans. In: *The 10th International Conference on Autonomous Agents and Multiagent Systems-Volume 3* (pp. 937-944). International Foundation for Autonomous Agents and Multiagent Systems.
- Fabregues, A. & Sierra, C. (2011). Dipgame: a challenging negotiation testbed. *Engineering Applications of Artificial Intelligence*, 24(7), 1137-1146.
- Fabregues, A. (2012). Facing the Challenge of Automated Negotiations with Humans. PhD thesis, Universitat Autònoma de Barcelona, 2012.
- Faratin, P., Sierra, C., & Jennings, N. R. (2002). Using similarity criteria to make issue trade-offs in automated negotiations. *Artificial Intelligence*, 142(2), 205-237.

- Fatima, S. S., Wooldridge, M., & Jennings, N. R. (2007, May). Approximate and online multi-issue negotiation. In Proceedings of the 6th international joint conference on Autonomous agents and multiagent systems (p. 156). ACM.
- Ferreira, A., Lopes, C., Carso, H., Paulo Reis, L. (2015). DipBlue: a diplomacy agent with strategic and trust reasoning. In 7th International Conference on Agents and Artificial Intelligence (ICAART 2015) (pp. 398-405).
- Finnsson, H. (2012). Simulation-Based General Game Playing. PhD thesis, School of Computer Science, Reykjavik University.
- Fox, J., Ahn, S. J., Janssen, J. H., Yeykelis, L., Segovia, K. Y., & Bailenson, J. N. (2015). Avatars versus agents: a meta-analysis quantifying the effect of agency on social influence. *Human-Computer Interaction*, 30(5), 401-432.
- Gal, Y. A., Grosz, B. J., Kraus, S., Pfeffer, A., & Shieber, S. (2005, July). Colored trails: a formalism for investigating decision-making in strategic environments. In Proceedings of the 2005 IJCAI workshop on reasoning, representation, and learning in computer games (pp. 25-30).
- González-Calero P.A. & Gómez-Martín M.A. (Eds.) (2011). Artificial Intelligence for Computer Games. DOI 10.1007/978-1-4 419-8188-2_2, New York: Springer.
- Graham, D. (2013). Breathing Life into Your Background Characters. *Game AI Pro: Collected Wisdom of Game AI Professionals Hardcover – September 11*, 451-458.
- Kelley, H. H. (1966). A classroom study of the dilemmas in interpersonal negotiations. *Strategic interaction and conflict*, 49, 73.
- Kocsis, L., & Szepesvári, C. (2006). *Bandit based Monte-Carlo Planning*. In Euro. Conf. Mach. Learn. Berlin: Springer, 282–293.
- Kraus, S. (2001). *Strategic negotiation in multiagent environments*. Montreal, Quebec: MIT press.
- Lorek, P. (2012). Sieci neuronowe w optymalizacji i prognozowaniu decyzji zarządczych oraz programowaniu zrównoważonego rozwoju [Neural networks in the optimization and forecasting of management decisions and programming of sustainable development]. In Olszak C.M. & Ziemia, E. (Eds.), *Technologie informacyjne w transformacji współczesnej gospodarki*. Zeszyty Naukowe Wydziałowe Uniwersytetu Ekonomicznego w Katowicach (pp. 87-94). Katowice: Wydawnictwo Uniwersytetu Ekonomicznego w Katowicach.
- Lucas, M., Mateas, M., Preuss, M., Spronck, P., & Togelius J (Eds.). (2013). *Artificial and Computational Intelligence in Games*. Lebnitz: Dagstuhl Publishing, Dagstuhl Follow-Ups – Vol. 6.
- Meier E., Biedron, S.G, LeBlanc, G., & Morgan, M.J. (2011). Development of a novel optimization tool for electroninacs inspired by artificial intelligence techniques in video games. *Nuclear Instruments and Methods in Physics Research A* 632, 1–6.
- Mell, J., & Gratch, J. (2017). Grumpy & Pinocchio: Answering Human-Agent Negotiation Questions through Realistic Agent Design. In S. Das, E. Durfee, K. Larson, & M. Winikoff (Eds.), *Proceedings of the 16th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2017)*, May 8–12, 2017, São Paulo, Brazil.
- Mell, J., Lucas, G., & Gratch, J. (2015). An Effective Conversation Tactic for Creating Value over Repeated Negotiations. In Bordini, Elkind, Weiss, Yolum (Eds.), *Proceedings of the 14th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2015)*, May, 4–8, 2015, Istanbul, Turkey.
- Peled, N., Gal, Y. A. K., & Kraus, S. (2011, May). A study of computational and human strategies in revelation games. In The 10th International Conference on Autonomous Agents and Multiagent Systems-Volume 1 (pp. 345-352).
- Robu, V., Somefun, D. J. A., & La Poutré, J. A. (2005, July). Modeling complex multi-issue negotiations using utility graphs. In Proceedings of the fourth international joint conference on Autonomous agents and multiagent systems (pp. 280-287). ACM.

Rosenfeld, A., Zuckerman, I., Segal-Halevi, E., Drein, O., & Kraus, S. (2014, May). NegoChat: a chat-based negotiation agent. In Proceedings of the 2014 international conference on Autonomous agents and multi-agent systems (pp. 525-532). International Foundation for Autonomous Agents and Multi-agent Systems.

Silver, D., Huang, A., Maddison, C. J., Guez, A., Sifre, L., van Den Driessche, G., Schrittwieser, J., Antonoglou, I., Panneershelvam, V., Lanctot, M., et al. (2016). Mastering the game of Go with deep neural networks and tree search. *Nature*, 529(7587), 484–489.

Stanley, K.O., & Miikkulainen, R. (2002). Evolving neural networks through augmenting topologies. *Evolutionary Computation*, 10(2), 99–127.

Stanley, K.O., Bryant, B. D., & Miikkulainen, R. (2005). Real-time neuroevolution in the NERO video game. *Evolutionary Computation, IEEE Transactions on*, 9(6), 653–668.

Van Kleef, G. A., De Dreu, C. K., & Manstead, A. S. (2004). The interpersonal effects of emotions in negotiations: a motivated information processing approach. *Journal of personality and social psychology*, 87(4), 510.

Wong, S.K., & Fang, S-W. (2012). A Study on Genetic Algorithm and Neural Network for Mini-Games. *Journal of Information Science and Engineering* 28(1), 145-159.

Yang, Y., Falcão, H., Delicado, N., & Ortony, A. (2014). Reducing Mistrust in Agent-Human Negotiations. *IEEE Intelligent Systems*, 29(2), 36-43.

Gamification in higher education – the example of a Microeconomics course in bachelor studies

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Abstract: Gamification as game-based learning is widely commented on as a tool which raises the effectiveness of the educational process by increasing the engagement and motivation of learners, but the effectiveness of this approach still requires testing. The purpose of the paper is to examine the influence of implementing gamification elements on the outcomes of economic education at the university level. The game-based elements were implemented in the Microeconomics course, perceived as one of the most difficult for students, being in the course curriculum in the first semester of all Bachelor degrees. The relationship between the results of the final exam and students' involvement in the game-based elements of the course was analysed. Research results show that to some extent, gamification has a positive impact on educational outcomes. The regression function parameters of gamification elements were positive and statistically significant, but the game-based elements do not explain the whole variance of educational outcomes, which means that they are not the only factor influencing the outcomes of the learning process. Implementing game-based elements into education can increase the effectiveness of the learning process, but it should be strictly combined with the content of the course and the skills and competencies required in a given course.

Keywords: gamification, learning outcomes, game-based learning

1 Introduction

Game-based learning is becoming a more and more common approach to learning because it is perceived as a tool which raises the motivation and engagement of learners by implementing game elements into the education process. However, there is currently no universally accepted method of assessing the effectiveness of implementing gamification and its influence on learning outcomes. The prevailing belief is that research is necessary to allow for full understanding of the contexts within which gamified learning activities are effective (Buckley et al. 2017).

The purpose of the paper is to examine the influence of implementing gamification elements on the outcomes of economic education at a higher education level. As the most frequent studies in this field are based on surveys asking responders' opinions, the paper's originality is connected to the experiment on gamification done with students and the created measures of game-based elements in education. Students faced the game-based elements as part of a regular and obligatory *Microeconomics* course at the bachelor level and their engagement and

results were accepted as measures of gamification. Thanks to this attitude, the influence of game-based elements on learning outcomes could be estimated, with the use of parameters of regression function.

Modern pedagogical concepts, based on a constructivist paradigm, put the student and their involvement at the center of the didactic process. These concepts assume that learning is an active process and involves individual construction of processes of discovery, their adaptation to current needs and their addition to existing knowledge structures. Learning is thus assumed to happen when (Gawel and Wach-Kakolewicz 2016):

- New information is incorporated into existing processes of discovery, supplementing knowledge, skills and the current understanding of the world;
- Learners construct their knowledge base in an active manner;
- Learners activate and utilise their existing knowledge;
- Learners make use of various sources of information during the process of discovery/resolving research questions;
- Tasks are given for the learner in a context relevant to them;
- Learners are encouraged to reflect on their current knowledge, and also consider new learning situations;
- Learners are socially engaged, and learn from each other;
- Autonomy and independence are encouraged.

Educational constructivism, to a certain degree, sets out the roles and tasks of teachers, who help their students achieve educational goals through the planning of appropriate didactic situations. As such, teaching is not understood so much as a transfer of knowledge, but of creating interesting situations to enable discovery and learning, and the teacher is not only a source of information, but a designer and coordinator of discovery processes for students (Gawel and Wach-Kakolewicz 2016).

However, student directed approaches do not necessarily guarantee effective learning. Sometimes learners lack prior knowledge, to allow them to fully utilise new educational experiences. They may also lack motivation to learn or show a high level of discomfort (Des Armier et al. 2016).

Acceptance of the principles of the constructivist approach to learning would mean that traditional teaching methods such as lectures, seminars or readings, should be replaced with integrated methods. These include techniques such as problem solving, programming, expository or practical tasks. One such group of problem solving activities are educational games (Wach 2014).

As early as the 1940s, the interest and involvement of people in games could already be observed, and the contributions of such games to social development were widely acknowledged. An increasing number of players brought about the implementation of games

in the business context to achieve various organisational goals, whereas the logical, atmospheric and technical elements of games found applications in many areas of business and everyday life (Kania and Smolarek 2017). Because games can be applied to various activities that are not strictly related to gaming, in different contexts and scopes, a variety of terms are used to describe this process. One of the most commonly used is gamification.

Although no precise definition currently exists, gamification is generally treated as an activity in which solutions characteristic of entertainment games are used in other situations (Woźniak 2017). Gamification refers to bringing in game-based mechanics, aesthetics and game thinking in non-game contexts (Furdu et al. 2017). This approach aims to increase the motivation and engagement of the participant (Cheong et al. 2014).

“Game elements” refer to elements of an activity that are characteristic to games, such as points, avatars, badges, reputation level, tasks, and leader boards (Cheong et al. 2014; Furdu et al. 2017). Use of these elements should be consistent and holistic (Cheong et al. 2014), so that the process of gamification is logically sound and can realise the goals that are set.

Gamification is not a simple process of adding common game elements to existing systems. In fact, correct implementation can be quite complicated (Cheong et al. 2014). For gamified activities to be introduced successfully, the following attributes must be combined correctly to create a cohesive whole (Buckley et al. 2017):

- A system of prizes, which players receive for achieving goals or overcoming obstacles.
- A system of trial an error, which allows players to practice, experience, reflect and learn.
- Objective and specific rules of gamified activities,
- Competition as a motivational tool.

The use of gamification in business, marketing and corporate management is continually increasing in popularity. In particular, applying gamification to education is a growing trend (Dicheva et al. 2015). In the area of human resources, gamification is used to improve motivation among course participants, as well as during the recruitment and selection of new employees (Woźniak 2017, Hauk 2017). It is used to improve sales conversations and build relationships with clients. Businesses create an environment where the client can communicate and compete with others, win prizes and points, and progress to ever higher levels of involvement. Because of this, the mechanics of the game are applied in order to realise marketing objectives such as increasing sales and improving brand recognition (Radziszewska 2017).

In 2013, gamification found itself at the top of the Gartner Hype Cycle, and was at the stage described as „the peak of inflated expectations”. In 2014 it entered the „Trough of disillusionment”, with the possibility of entering widespread use within 5-10 years (Kania and Smolarek 2017; Hauk 2017). When it was observed that the majority of gamification projects tended to end in failure, it became apparent that gamification does not consist of simply adding badges and levels to an existing points system, or organising new competitions.

Because of this, current research focuses on projects that have already been activated, and on looking for ways to methodically, successfully implement gamification projects and define critical determinants of success (Kania and Smolarek 2017).

One of the particularly relevant applications of gamification is education. Game elements are introduced to the teaching process with the aim of stimulating learners and increasing students' engagement and motivation, which in turn causes learning outcomes to improve. The motivational power of gamification comes from the use of a range of mechanisms to encourage students to engage with the activities, mostly because of the pleasure of the game itself and also the possibility of winning (Dicheva et al. 2015). The first documented reference to „gamification” comes from 2008, although gamification elements were used much earlier in the process of teaching to improve the competencies of learners (Çeker and Özdamlı 2017).

2 Gamification in education and its efficiency

The literature pertaining to this subject describes several approaches that are based on the use of games in an educational context, depending on the complexity of the game elements used (Nowacki and Ryfa 2015):

- Edutainment – a combination of education and entertainment that was especially popular in the 1990s. This approach was used mainly in pre-elementary school education and took the form of simple video games and board games (Nowacki and Ryfa 2015),
- Serious games – digital games which are used for other purposes than simply for entertainment (Looyestyn et al. 2017), this group of activities includes business and managerial simulations (Nowacki and Ryfa 2015),
- Game-based learning – this adapts the educational content to fit the game's story and rules (Furdu et. al. 2017),
- Gamification – when game elements are introduced into the educational process to motivate the students and keep them engaged (Furdu et. al. 2017).

The main difference between gamification and educational games is that educational games use a fully established game design, where gamification only uses certain game elements (Çeker and Özdamlı 2017).

Serious games use a combination of different teaching methods such as practical exercises and case studies, whereas *edutainment* is based on repetition and remembering (Nowacki and Ryfa 2015).

In game-based learning, the educational process progresses mostly by playing games, which is the main focus. In gamification, games are simply part of a learning process which helps to engage learners (Çeker and Özdamlı 2017).

Despite the increasing popularity of gamification and other approaches based on the use of game mechanics in education, there is no conclusive evidence for its effectiveness when

applied to the teaching process. Despite the increasing number of studies on the use of gamification in education, most of them only describe certain mechanisms and game dynamics and their possible application in the educational context. However, studies indicating the expected effectiveness in introducing game elements to education are still rare (Dicheva et. al. 2015). What is lacking in the economic community is a set of widely accepted standards for gamification and learning outcomes, as well as a set of indicators of effectiveness for the use of gamification in the teaching process, or methods of measuring its impact.

Part of the research intended to define the effectiveness of gamification in the educational process is survey based, where learners are asked to give their assessment of the method. According to the results of these surveys, many students prefer gamification to traditional methods such as lectures (Henning et. al. 2017). Students positively assess an educational system which uses game elements, in particular they appreciated the social interaction, engagement, feedback and improved learning.(Cheong et. al. 2014) They are generally open to participating in gamification because of their own involvement, competition with others and desire to achieve the best results possible (Des Armier et al. 2016).

The influence of gamification on student involvement can be observed not only in relation to face to face teaching, but also in online programs. However, the positive effect seems to lessen over time as game elements, rewards in particular, wear off after a short period of novelty (Looyestyn et al. 2017).

An overview of the subject literature indicates that the use of gamification brings the following benefits (Furdu et al. 2017):

- a better learning experience by combination of fun and learning
- a better learning environment
- instant feedback
- instigation of behavioural change,
- fulfilment of most learning needs.

Apart from the often emphasised issues of engagement and motivation, it is believed that gamification allows for some activities that are usually considered uninteresting by learners to be adapted to be more acceptable to them. Activities which require hard work and concentrated effort become pleasant, interesting tasks. Because of gamification learners find it easier to concentrate, they are more active and participate in the learning process. Learners can make use of media tools to achieve the set goals, and as a result are more aware of these tools and able to use them.(Çeker and Özdamlı 2017). An overview of the literature also indicates that the positive impact of gamification is very dependent on the educational context in which it is used, and on the personalities of the players (Buckley et al. 2017).

Gamification as a concept meets not only with praise, but also with criticism. The critique of applying gamification in education indicates that it is possible to reduce the internal motivation of players in exchange for developing external motivation (Buckley et al. 2017), because learners are often forced to be active as a result of the tasks imposed upon them,

which often also have time limits. If a game is mandatory, it can result in rule-based experiences that feel just like school.

Another problem may be the rewards system as learners should be rewarded based on their effort, not mastery of the game, and they should learn to see failure as an opportunity (Furdu et al. 2017).

The context in which gamification is applied is a crucial determinant of its effectiveness, along with factors such as class size, educational level and perceived stakes. Moreover, gamification suits some students and their learning styles better than others (Buckley et al. 2017).

The results of research related to corporate training exercises also suggest caution in assessing the effectiveness of gamification. Correlations between the gamified learning usage and the minds of corporate learning leaders, their competences and the organizational culture profiles of their companies were shown to be statistically irrelevant. This in turn forces us to question existing predictions about the future of gamified learning (Lambert, 2017).

One problem with introducing gamification into the classroom might be the experience and attitudes of teachers. Research results among business teacher educators show that they had knowledge of gamification, but lacked a clear understanding of it. They also might not be aware of the effectiveness of this teaching strategy (Fisher et al. 2014).

To summarise, gamification has the potential to improve learning, but proper design and application are necessary for success (Dicheva et al. 2015). More representative research on the effectiveness of implementing gamification in the learning process is also necessary, and also clearly defined parameters for its use.

3 The parameters of the experiment with gamification in higher education

Although higher education would seem like an appropriate environment to introduce a constructivist teaching paradigm, many subjects taught at this level make it very challenging to practically apply this approach. This has as much to do with the content as with the way teaching is organised. Courses which focus on general knowledge from a given field have problems with referring to students' prior knowledge, as they often do not have this. One such subject is *Microeconomics*, which is taught at the Poznań Economics University, in the first semester of all undergraduate courses. This is the first subject in the field of economics that students encounter during their education. Students are often recruited from secondary schools without having prior knowledge of economics. This subject is often regarded as one of the most challenging at economics universities.

The difficulty of this subject results from several factors. Apart from a lack of prior knowledge in this area, students encounter specific economic terminology as well as alternative ways of presenting theories, not only through words but also through graphs and mathematical equations. The curriculum is also quite expansive. Additionally, attending lectures is voluntary, as this is standard university policy. This results in a situation where students have trouble understanding the material and stop attending lectures, which in turn causes the gaps in their

knowledge to increase. The end result is that a significant proportion of students are unable to pass the final exam, or drop out during the semester.

In order to define the effect of gamification on learning outcomes, a teaching experiment was conducted to collect data. Every week during the whole semester, students could collect points for answering quiz questions; answering questions was timed, and students received immediate feedback on the correctness of their answers. The students who answered most quickly were declared the winners. Students used an online platform to answer quiz questions. The number of collected scores was contributed to a higher grade on the final exam. Students' participation in this activity was voluntary. To summarize, the following game-elements were used:

- Points system – students were awarded points for correctly answering quiz questions,
- Rewards system – collecting points was rewarded by improving the grade of the final exam
- Reputation levels – following the university grading system (possible grades: 2,0 being a fail; 3,0; 3,5; 4,0; 4,5; 5,0), the number of points gathered allowed the final grade to be improved accordingly by 0,5 or 1 grade.
- leader boards – after each quiz question, the names of the first 3 students who correctly answered the question were displayed as winners.

In total, students could earn 13 points, where they would be given two quiz questions to answer after each lecture and each correct answer was worth one half point. The data collected during this experiment allowed for three factors to be identified as the variables which explained the results of the learning process. Two of these variables reflected the degree to which students were involved in gamification exercises. These were the number of points collected through quizzes (P) and the frequency of participation (F). In the case of both variables the maximum number of points that could be earned was 13.

The correctness of answers (A) was treated as the control variable, and this showed how well students retained and applied new knowledge. This variable was defined as the percentage of correct answers among all questions answered by that particular student. As such, it showed the ability of the student to acquire knowledge, regardless of how involved they were in the gamification exercises.

The microeconomics course concluded with a written exam, where between 0 and 30 points could be awarded. Passing the practical part of the course (seminars and exercises) was a condition of being permitted to take the exam, which meant that not all students had the opportunity to do so. A student who failed the final exam or was not allowed to take it in the first place is allowed a retake, but the results of these retake exams were not counted for the purposes of the research.

Next, econometrical analyses were conducted to answer the research questions. The number of points collected in quizzes (P) and the frequency of participation in quizzes (F) were accepted as measures of gamification and were treated as independent variables. The

accuracy of answers (A) was treated as the control variable, showing students' possibilities to acquire knowledge. Scores obtained by students during the written final exam were treated as a measure of learning outcomes and dependent variable (LO).

4 Gamification and learning outcomes – results of the experiment

During the 2017/2018 winter semester, a didactic experiment was conducted among first year students doing a full time undergraduate course in the International Economics department at the Poznań Economics University. The winter semester lasted from October 2017 to February 2018. At the beginning of the semester, 204 students were enrolled in a *Microeconomics* course. However, some students in this group dropped out of the course and did not take the final exam. In particular, depending on their involvement in gamification and whether or not they continued their studies, students were grouped as follows:

- 157 students, who took part in gamification and were permitted to take the final exam,
- 14 students, who did not take part in gamification, but were permitted to take the final exam,
- 13 students, who took part in gamification at least once, but dropped out or were not present at the exam for other reasons,
- 20 students, who did not take part in gamification and also dropped out of university.

As it can be seen, 170 students, so more than 83% of those enrolled in the first year of the course took part in activities connected with gamification, even though they began in the third week of the course. Participation in lectures is voluntary, as per the policy of the Poznań Economics University. In addition, a large percentage of students enrol in undergraduate courses and then do not participate further. They are treated as students for the entire first semester, and are only removed from the register of students after the end of the winter exam session. Taking into account these limitations, it should be positively assessed in the degree of student involvement in gamification activities.

Comparing the average score from a *Microeconomics* exam taken by students from the first and second groups, the students who participated in gamification activities at least once achieved an average result of 11,01 points, so 36,7% of the total points available. However, students who did not take part in any of the offered gamification activities achieved an average result of 6,07 points, so 20,2% of the total points available. As such, it can be seen that student involvement is a factor which differentiates obtained learning outcomes.

In the later stages of the research, the only results taken into account were those obtained by students who took part in gamification activities at least once. Defining the degree of their involvement in gamification and its relation to their learning outcomes was only possible with this group of students, which gives a point of reference for the research questions.

Table 1 shows a set of descriptive statistics representing the results obtained by students, in accordance with the parameters of the research. Scores obtained by students in the final written exam were treated as a measure of learning outcomes (LO), whereas the number of

collected points in quizzes (P) and frequency in quiz participation (F) as measures of gamification. The accuracy of answers (A) was the control variable.

Table 1: Descriptive statistics of variables

	LO – scores for written exam	P – points for quiz answers	F – frequency in gamification activities	A – accuracy of quiz answers
Average	11,0128	4,1154	7,4487	0,5254
Standard deviation	7,5040	2,8335	3,7335	0,2022
Max value	30	11,5	13	1
Min value	0	0	1	0
Mediana	11,5	3,5	8	0,5

Source: Author's estimations

On average, students earned 4,1 points for the quiz answers and took part in 7,5 activities connected to gamification, out of a total of 13 possible in both cases. As such, students were active during 57,2% of possible meetings, and there were some students who took part in all possible meeting and some who only took part once. On average, students earned 31,7% of possible points for quiz answers, with the highest score bring 11,5. However, there were also students who did not answer a single question correctly. On average, students answered questions correctly in 52,5% of cases.

After data were collected, an econometric analysis was conducted. The first step was to analyse the correlation coefficient between the exam results as learning outcomes, and the variables related to gamification, along with the control variable. As the results in table 2 show, the correlation coefficients between gamification related variables and learning outcomes are comparable about (0,45), whereas the correlation between learning outcomes and the control variable is much lower.

Table 2: Correlation coefficients between learning outcomes (LO) and gamification variables and control variable

Points in quizzes (P)	0,46
Frequency in quiz participation (F)	0,44
Accuracy of answers (A)	0,29

Source: Author's estimations

A key step in the econometric analysis is estimating the parameter values of the regression function, where learning outcomes are the dependent variable, and the independent

variables are the ones connected to gamification, as well as the control variable. The initial form of the assumed regression function was as follows:

$$(1) LO = a_0 + a_1P + a_2F + a_3A$$

Where:

LO – learning outcomes,

P – Points earned by students in quizzes as a measure of participation in gamified activities,

F - Frequency in quiz participation as a measure of participation in gamified activities,

A - Accuracy of answers of quiz questions as the control variable,

a_0, a_1, a_2, a_3 – function parameters

However, because of the fact that each of the variables was expressed using different variables and could take on a range of values, the second step of the research estimated the parameters of the regression function separately for each independent variable, using the following equations:

$$(2) LO = a_0 + a_1P$$

$$(3) LO = a_0 + a_1F$$

$$(4) LO = a_0 + a_1A$$

Estimating the function parameters proceeded using the classic least squares method. A summary of the estimates for the function parameters (1 to 4) is presented in table 3.

Table 3: Results of regression function parameters' estimation

	Value of coefficient	Standard error	t-Student	P value	Coefficient of determination R^2
Function (1)					
Const (a_0)	2,5594	2,6796	0,9552	0,3410	0,2258
P	0,3098	0,6434	0,4815	0,6309	
F	0,6084	0,3913	1,5550	0,1220	
A	5,1686	4,7915	1,0790	0,2824	
Function (2)					
Const (a_0)	6,0064	0,9490	6,3290	<0,0001	0,2135
P	1,2334	0,1901	6,48700	<0,0001	
Function (3)					
Const (a_0)	4,4802	1,2186	3,6770	0,0003	0,1914
F	0,8861	0,1463	6,0580	<0,0001	
Function (4)					
Const (a_0)	5,3331	1,6116	3,3090	0,0012	0,0863
A	10,9559	2,8641	3,8250	0,0002	

Source: Author's estimations

The values of the regression function (1) were shown to be statistically insignificant. It could be surmised that the reason for this might have been the fact that these variables were expressed using different values. LO showed the number of points students scored on an exam, in a range of 0 to 30. The number of points earned during gamification activities (P), and frequency (F) had a possible range of values from 0-13. Accuracy (A), since it showed the proportion of correct answers given by a particular student, and thus was expressed either as 0 (no correct answers) or 1 (all correct answers). At the same time, since a part of the results had a value of 0, there was no possibility of converting the data to natural logarithms.

Because of this, results estimating the function parameters in the range of (2) to (4) were also taken into account. As can be observed, all explanatory variables turned out to be statistically relevant in to explaining the progression of the explained variable, and as such they take on positive values. As such, participation in gamification may be one of the variables that positively affect the academic results achieved by students.

Students achieving a higher score through correctly answering quiz questions lead to better learning outcomes. To give the correct answers, students had to actively gain knowledge relating to the material of the microeconomics course, which was presented during the lecture cycle. In doing so, they increased their knowledge of the subject. At the same time, because many of the quiz questions were based on reading the progression of variables on charts, a new approach to teaching compared to how data was presented in earlier stages of education, students also had the opportunity to develop the ability to do this.

The level of engagement shown by students during gamification activities (measured by tracking attendance) also positively affects learning outcomes, and is statistically relevant. When students took part in gamification activities more often, their scores on the final exam also increased. Taking part in activities caused students to have ongoing contact with material taught during lectures and the microeconomics curriculum in general, and could systematically verify the knowledge they had obtained, and ensure good comprehension and long term retention of this knowledge. The greater their involvement, the more they engaged with the teaching process, obtaining better exam results in the process.

Since the variables connected to gamification took on values in the same range, it is possible to compare them. The parameter showing the number of points earned for quiz answers has a higher value than the parameter showing attendance, which allows us to state that it affects student learning outcomes to a greater degree Attendance on its own may have a more passive dimension. In order to get good results, students had to not only attend lectures, but also remember the material that was taught, and also study for the quizzes independently. As such, achieving high quiz scores required more involvement than just attending lectures, which in turn led to higher learning outcomes. The final variable analysed, which was treated as the control variable, was the accuracy of test answers. This was measured as the percentage of correct answers in all questions that were answered. This variable was included in the research, because it shows to a certain degree the natural capabilities of students to master the material irregardless of their involvement in gamification. As the results show, the effect of this variable on learning outcomes is also positive and statistically relevant.

If the values of the coefficient of determination R^2 of (2) to (4) functions are examined, we can observe that the variables connected to gamification and the control variable do not explain more than approximately 20% of the variations in learning outcomes as a dependent variable, which is not a particularly strong relationship. Among the three variables, the variance in learning outcomes is best explained by the variable connected to gamification which shows the number of points earned by students for correct quiz answers. Looking at the value of the R^2 variable, the degree to which exam results are explained by the control variable is quite low. The results indicating the values of the determining variables should not be surprising. The learning process is a complicated one that is affected by personality and environmental factors. In addition, gamification activities are only one of the elements of the teaching process. Other elements such as the curriculum, the organisation of the teaching process and the way lectures are conducted are just as relevant.

5 Final conclusions

Gamification as game-based learning is widely commented on as a tool raising the effectiveness of educational process by increasing the engagement and motivation of learners, but the effectiveness of this attitude still requires further testing. The most frequent studies in this field are based on surveys asking responders' opinions. The paper's originality is connected to the experiment on gamification done with students and the created measures of game-based elements in education. Students faced the game-based elements as part of a regular *Microeconomics* course, and their engagements and results were accepted as measures of gamification. Thanks to this attitude, the influence of game-based elements on learning outcomes could be estimated with the use of parameters of regression function.

According to the research results, game-based elements have a positive and statistically significant impact on the learning outcomes, but the game-based elements do not explain the whole variance of the educational outcomes and they are not the only factor influencing the outcomes of the learning process.

Implementing game-based elements into education can raise the effectiveness of the learning process, but it should be strictly combined with the content of the course and the skills and competences required in a given course. Gamification should be treated as a valuable part of the education process, which should be carefully designed and comprehensive with other elements of education.

References

- Buckley, P., Doyle, E., Doyle, S. (2017). Game On! Students' Perceptions of Gamified Learning. *Educational Technology & Society*, 20 (3), 1–10.
- Çeker, E., Özdamlı, F. (2017). What "Gamification" is and what it's not. *European Journal of Contemporary Education*, 6(2), 221-228.
- Cheong, Ch., Filippou, J., Cheong, F. (2014). Towards the Gamification of Learning: Investigating Student Perceptions of Game Elements. *Journal of Information Systems Education*, 25(3), 233-244.

- Des Armier, Jr., D., Shepherd, C.E., Skrabut, S. (2016). Using Game Elements to Increase Student Engagement in Course Assignments. *COLLEGE TEACHING*, 64(2), 64–72.
- Dicheva, D., Dichev C., Agre G., Angelova G. (2015). Gamification in Education: A Systematic Mapping Study. *Educational Technology & Society*, 18 (3), 75–88.
- Fisher, D.J., Beedle, J., Rouse, S.E. (2014). Gamification: A Study Of Business Teacher Educators' Knowledge Of, Attitudes Toward, And Experiences With The Gamification Of Activities In The Classroom. *Journal for Research in Business Education*, 56(1), 1-16.
- Furdu, I., Tomozei, C., Köse, U. (2017). Pros and Cons Gamification and Gaming in Classroom. *BRAIN: Broad Research in Artificial Intelligence and Neuroscience*, 8(2), 56-62.
- Gawel, A., Wach-Kąkolewicz, A. (2016). Konstruktywizm edukacyjny w nauczaniu przedsiębiorczości metodą gier elektronicznych. *Horyzonty Wychowania*, 15 (34), 87-102.
- Hauk, M. (2017). Grywalizacja w rekrutacji – pytania sytuacyjne w formie gry jako pomysł na urozmaicenie procesów selekcji kandydatów. *Zarządzanie Zasobami Ludzkimi*, 2(115), 164-177.
- Henning, M., Hagedorn-Hansen, D., von Leipzig, K.H. (2017). Metacognitive Learning: Skills Development Through Gamification At The Stellenbosch Learning Factory As A Case Study. *South African Journal of Industrial Engineering*, 28(3), 105-112.
- Kania, K., Smolarek, M. (2017). Analiza rozwoju gamifikacji biznesowej na przykładzie przedsięwzięć realizowanych w Polsce. *Informatyka Ekonomiczna*, 2(44), 60-71.
- Lambert, V. (2017). Gamification and the Quality of Informal Post-Experiential Learning. *Management*, 12(3), 249–271.
- Looyestyn, J., Kernot, J., Boshoff, K., Ryan, J., Edney, S., Maher, C. (2017). Does gamification increase engagement with online programs? A systematic review. *PLoS ONE*, 12(3): e0173403.
- Nowacki, F., Ryfa, J. (2015). Zastosowanie klasyfikacji użytkowników gier w nauczaniu opartym na grywalizacji, *STUDIA OECONOMICA POSNANIENSIA*, 3(5), 175-189.
- Radziszewska, A. (2017). Uwarunkowania skutecznego wykorzystania gamifikacji w działaniach marketingowych. *Handel Wewnętrzny*, 6(371), 284-291.
- Wach, K. (2014). Edukacja dla przedsiębiorczości: pomiędzy przedsiębiorczą pedagogiką a edukacją ekonomiczną i biznesową. *Horyzonty Wychowania*, 13(28), 11-32.
- Woźniak, J. (2017). Some Factors Hindering Acceptance of Three Gamification Solutions in Motivation Systems in Small and Medium Enterprises. *Management Dynamics in the Knowledge Economy*, 5(4), 663-680.

Human Resource Management

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Due to the growing internationalization of enterprises activity along with their expansion to the international markets and ease of transfer among countries, more and more employees seek career development opportunities on the international labor market. HRM therefore, faces multiple challenges of the modern labor market: managing people in diversified workplace, age management, Generation X, Y, Z management, expatriation management. International migrations and their multi-sphere socio-economic consequences are today one of the key determinants of human resources in a global dimension. Papers in this stream aim at sharing and exchanging research results as well as are of theoretical or conceptual nature about new challenges HRM faces, both internationally and locally, including international corporations as well as public intuitions and SMEs.

Self-initiated expatriation in organizational terms - theoretical discourse

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Abstract: Self-initiated expatriation is a new trend in the area of expatriation, which emerged in recent years. The publications of previous years were to a large extent related to the SIE studies from the western developed countries. The interest in the phenomenon of SIE in recent years has significantly increased, which has also expanded the geographical area of research. Numerous publications devoted to self-initiated expatriates (SIE) and self-initiated expatriates (SIE) to the extent to fill in the theoretical gap, and empirical. The aim of the theoretical article is to present the complexity of the problem of self-proclaimed expatriates in organizational terms. Due to several publications on the organizational aspect of the SIE, a critical assessment of the current achievements of world scientists in this field was made to underline the need to continue further research in this field.

Keywords: self-initiated expatriates, self-initiated edxpatriate, expatriates, assigned expatriation

1 Introduction

The globalized world economy requires more and more mobility and flexibility. More often, specialists are looking for international career opportunities, and employers face the problem of competency gaps. It is becoming increasingly difficult for them to acquire people with particularly sought knowledge and skills (Kocór i Strzebińska 2010). Demographic changes (including the aging of societies), rapid development of communication technologies, modern technological solutions encourage employees worldwide to deliberately give up permanent employment for more flexible forms of work, in particular self-initiated expatriates.

The first part of the study identifies flexible forms of work on the international market. The second subsection concerns the phenomenon of self-initiated expatriation and self-initiated expatriates challenging international organizations in managing this group of employees. The last one, however, summarizes the theoretical discourse undertaken and implies the need to continue further research of this area.

The main purpose of the article is to present the phenomenon of self-initiated expatriation in the organizational dimension.

The text is a compilation of previous (few) SIE publications from an organization's perspective (eg Mayrhofer and others 2008, Howe-Walsh and Schyns 2010, Makkonen 2017).

2 Selected macrotrends conditioning the development of flexible forms of employment

The situation on the labor market is changing dynamically not only in Poland, but also around the world. According to the Hays report conducted in 2017 in 33 countries, the demand for low- and medium-qualified employees is decreasing, and the number of highly qualified specialists increases.

It is necessary to take into account numerous global trends appearing in contemporary societies, including migration, demographic changes including aging of societies, technological progress, development of new flexible forms and conditions of employment or a shortage of particularly talented employees. These phenomena appear in the external environment, but at the same time penetrate into the environment of the internal organization.

The following table presents the selected macrotrends in the subject literature that determine the development of flexible forms of employment and their implications for the organization.

Table 1. Selected macrotrends conditioning the development of flexible forms of work and their implications for HRM

	Macrotrends	Characteristics of the phenomenon	Implications for the organization
Macrotrends	International migration	Migration is treated by researchers as a phenomenon significantly affecting the demographic situation. Migration movements affect not only the size of the population in a given region, but also its structure in terms of age, sex or education. Migration processes have become particularly important in the era of globalization, since the elimination of barriers to the free flow of financial capital and wealth, leads to the free movement of people.	According to Global Mobility Policy & Practices, half of the surveyed international organizations expect that the mobility of employees will increase. Three-quarters of these entities note the need to introduce flexible employee mobility programs due to the changing needs of employees and the growing expectations of employers.
	Demographic change	The aging process of societies is one of the elements of demographic change. The reasons for this state of affairs should be seen in both demographic and socio-economic factors. These include, among others, women's occupational activation, fertility decline, population migrations and life extension.	The period of old age means professional passivity and exit from the labor market. Change in the proportion of employment of representatives of different generations, less and less activity of the generation of baby boomers and generation X. The need to prepare the organization for the emergence of Z generation on the labor market.
	Development of new technologies	The development and dissemination of new technologies have a significant impact on the labor market. They allow you to increase productivity and efficiency of work, and sometimes also to replace work previously performed by people with software work	The development of new technologies forces employers to look for new, different competences for employees. Training in the field of implemented technologies and building an employer's brand become more and more important, attracting the most talented

		or machines, which in the case of falling technology costs allows to reduce production costs and services. This situation is conducive to people who have appropriate competences to use new technologies.	specialists, ready to support modern solutions used in the company. The consequence of the development of new technologies is the development of marketing and communication tools and channels, for example the creation of new digital marketing manager, social media manager and community manager positions.
	Talent management	The concept of talent is interpreted differently by individual authors. In the literature on the subject one can find various definitions and concepts of this concept. The definition of talent management refers to a set of activities concerning exceptionally gifted people, with the intention of identifying, developing and maintaining them and engaging in appropriate organizational processes. The effectiveness of the talent management system in the organization is determined by four of its elements: attracting talents, maintaining talents, managing talents, identifying talents.	Implementation of the TM system in the organization is associated with many positive aspects, eg transfer of knowledge, mutual learning, raising the prestige of the organization, creating new jobs to search for and acquire talents, strengthen the team and constantly improve the competence. However, the implementation of this strategy is also associated with negative connotations such as: the danger of frustration, the possibility of buying a trained person by a competitive company, difficulties in adapting to the new environment. Talent, as a resource with above-average skills and knowledge, ready for new challenges and involved in the work performed, is an indispensable source of development for every organization. It creates a strong foundation of competitive struggle, constituting a source of innovative and creative solutions.

Source: own study based on: Moczyłowska (2014), Figura (2016), Miś (2009), Poczowski (2008), Mróz (2015), Bieniok (2010), Listwan (2010), Ingram (2011), Borkowska (2005), Mikula (2001), Brzeziński (2016), Steinerowska (2015), Cartus (2014).

The above table compares only part of numerous (specified in the above content) global trends determining the development of flexible forms of employment. The characterized phenomena imply the need for the organization to adapt to the international context of their activities, including accommodation in the area of personnel activities of HRM, and presented in the subject list.

The next subsection is devoted to the development of modern, flexible forms of employment.

3 Non-standard forms of foreign missions

The functioning of modern organizations in the conditions of a turbulently changing environment and permanent uncertainty forces the increase of their flexibility and adaptability. The ability to react quickly to changes becomes the basis of competitiveness. The need to adapt to changes requires the enterprise to make employment more flexible (Bombiak 2014). Enterprises have a wide and constantly expanding catalog of alternatives to traditional expatriation - long-term (assigned expatriation - AE) which lasts from 3 to 5 years.

The term "expatriate" refers to an employee of an international enterprise, usually a high-class specialist or manager, who is sent to foreign units (being a branch, branch or other organizational and legal form) from the corporate headquarters, from a third country, or moves between units. The expatriate may be derived from the country of origin of the corporate headquarters or be of a different nationality than the population of the home country of the corporation (Przytuła 2014).

The following list presents only a few of the many non-standard forms of expatriation.

Table 2. Characteristics of selected non-standard forms of expatriation

Forms of a foreign mission	Characteristic
commuter assignments	This type applies to employees commuting to work from the country of the headquarters to another country, usually for weekly or bi-week stays, during which the expat family stays in the country of origin. The advantage of this type of contract is the close relationship between the employee's home country and the country of the corporate headquarters. The disadvantage of this type of contract is the fatigue of employees with continuous travel (burnout), tax policy and lack of intercultural preparation for these expats on the part of corporations. In addition, frequent trips can negatively affect family relationships.
business traveler, frequent flyer	This form of expatriation is characterized by numerous and short business stays outside the home country, during which members of the immediate family remain in the country. The average duration of stay is about a week. The purpose of the trip is to participate in discussions, meetings, conferences, ceremonies on the occasion of starting plants, negotiations, etc. The disadvantage of this type of contract is management costs and administration of individual employees, the threat of occupational burnout, stress related to traveling, health problems, lack of a systematic approach to managing this staff.
virtual assignments	Virtual tasks consist in managing employees or performing other tasks using modern technologies, in the form of teleworking without leaving their country of origin. Virtual expatriation is a combination of short business trips and telephone contacts to a foreign branch for a short period in order to establish direct contacts with local employees, and then continue to manage and oversee the branch remotely over the phone, the Internet, video conferencing.
Freelancer	They are the person who performs tasks assigned to him based on a contract other than a contract of employment. It is characterized by the freedom to choose orders, determine the hours and place of work. Freelancer is treated in the literature of the subject synonymously to a self-initiated expatriate.

Source: own study based on Przytuła (2012 2017), Purgał-Popiela 2013, Pocztowski (2012), Lazarowicz (2017).

Presented types of non-standard expatriation clearly indicate differentiation under the account of the duration of the foreign mission. In addition to the positive consequences of these contracts, including diversity and novelty of tasks, challenges, personal development, one can identify a number of negative aspects such as: health problems, difficulty in maintaining friendly and social contacts or inability to participate fully in family life.

Flexible forms of foreign missions are better for employers than traditional solutions. This is dictated, for example, by improving competitiveness through cost-efficiency, saving financial resources at workplaces, reducing the number and costs of training, eliminating costs related to downtime, thanks to the flexible and quick replacement of absent people.

Against this background, the phenomenon of self-initiated expatriation emerges, which is devoted to the next subsection.

4 The problem of self-initiated expatriation in the organizational dimension

Internationalization of the labor market, online recruitment systems, facilitation and reducing the costs of advertising the competition around the world and increasing the number of people gaining international professional experience or the desire to travel contribute to the increase in the number of self-initiated expatriates (Suutari, Brewster, Mäkelä, Dickmann, Tornikoski 2016).

Self-initiated expatriates (SIEs) are mobile international workers (Inkson et al 1997, Suutari and Brewster 2000) whose mobility has been combined with the possibilities of traveling or the desire to experience adventure and career development (Thorn 2009). An important factor in defining SIE is self-initiation of one's international relocation (Andresen et al., 2014). The length of a foreign stay is often not predetermined by the SIE, nor is it also planned for repatriation (Suutari and Brewster 2000). SIEs are a particularly valuable resource due to their intercultural skills, networks of local connections (Froese and Peltokorpi 2013) and greater cultural adaptation (Lo et al 2012).

Self-initiated expatriation is on the one hand an experience enriching the professional development of the individual, and on the other hand the result of rivalry between corporations to attract and employ "lean" resources of highly qualified employees able to ensure success on the international market (Farndale et al. 2010).

Opportunities to find a job abroad are still growing. An increasing number of employees consider this option to be realistic. As claimed by Tharenou and Caulfield (2010), SIEs are an important factor in the international labor market. They are an integral part of the international labor market and interest on the part of the organization (Peiperl and Jonsen, 2007).

SIEs do not focus on the traditional career and hierarchical development model (Doherty et al., 2011). They are also not affiliated with any organization (Bossard and Peterson 2005, Stahl et al 2002, Stahl and Cerdin, 2004). In addition, they may experience professional problems after returning to their country of origin (Begley et al. 2008). However, gained international professional experience increases their chances of promotion for the current employer and for new employment (Richardson and Mallon, 2005).

Some authors (eg Mayrhofer and others 2008) present SIE as a challenge to the strategy and practice of MZZL. This claim is based on the fact that being individualists and non-conformists, and giving priority to personal motives (Sullivan and Arthur 2006), can be a difficulty for the organization in managing them, eg in the field of recruitment, talent management or the level of commitment to the tasks entrusted. As stated by Peltokorpi (2008) due to personality traits such as emotional stability or cultural empathy are better adapted to different than traditional contexts.

The organization's SIE management strategy plays a key role. It is important to properly adapt the recruitment and selection procedures as well as to ensure cultural training and development opportunities. In terms of recruitment, HR practices must adapt to this foreign population, not only to avoid disabling it (for example neglecting preferred communication channels), but also to attract it (for example, not limiting the job offer to the technical description of the proposed position, but also providing general information on living facilities in the host country). For the company, the main benefit of this proactive and diverse approach is attracting and leaving this highly qualified workforce in the organization (Al Ariss 2015).

In organizational terms, the cost of SIE in comparison to traditional expatriation is usually lower, for example due to the lack of costs incurred by the organization in the form of travel and subsistence, remuneration and taxation costs. It is important for these and other reasons that organizations understand the nature and management of the SIE. However, despite the growing interest of SIE (eg Al Ariss 2010, Cerdin and Le Pargneux 2010, Crowley-Henry 2012, Richardson 2009), this phenomenon is still a significant research gap for both the research and the research community as well as in the practical sphere.

It is worth mentioning here some examples of the results of research conducted on the SIE in organizational terms.

Research conducted on SIE in China has shown that due to ignorance of host culture and lack of language skills, they have less influence on the development of the organization and face numerous difficulties in cooperation with local employees and superiors. International corporations operating in China see SIE as a potential pool of production workers constituting a risky and unstable choice (Makkonen 2017).

Organizational practices in the field of SIE management in the area of adaptation show that organizations do not pay due attention to this process, there are no system or standard software solutions, there are short-term actions often dictated by current needs and adjusted directly to the employee or from the maladjustment of the personality and cultural employee, which indicates irregularities already at the stage of recruitment and selection (Przytuła 2014, Kubica 2017, Poczowski 2012).

Bhuian et al. (2001) studying SIE in Saudi Arabia suggested that wages can be a significant motivator for working for high-paid jobs in a short period of time. Howe-Walsh and Schyns (2010) mention that organizations are often not prepared or able to manage SIEs due to the lack of appropriate strategy, policy and practice in this area. Suutari and Brewster (2000) pointed out that identifiable SIE subgroups can create different types of resources for which organizations need appropriate methods. By retaining the above considerations, most of the practices used by organizations tend to be "immediate and pragmatic" (Howe-Walsh & Schyns 2010).

5 Conclusions

Self-initiating expatriates are an important source of human capital for business organizations around the world. As employees, they have rich education, desirable global competences and

strong motivation. For an organization, SIE management is often a challenge, due to the lack of knowledge and practice in managing it. The literature on SIE focuses mostly on the perspective of an individual topic. However, there is little room for the organizational dimension of self-initiated expatriation.

The article is a theoretical discourse and does not pretend to be a comprehensive diagnosis of the problem. However, it presents its multifaceted dimension. The complexity of the topic due to its constant diversification requires further deepening.

References

- Al Ariss, A. (2010). Modes of engagement: migration, self-initiated expatriation, and career development. *Career Development International* Vol.15, No. 4. 340-342.
- Al Arris, A. (2015). Integration of self-initiated expatriates an essential part of hr strategy. *Career Development International*. 110-111.
- Andresen, M., Bergdolt F. & Margenfeld, J., (2014). What distinguishes self-initiated expatriates from assigned expatriates and migrants? A literature-based. *International Journal of Human Resource Management*. 23-23.
- Begley, A., Collings, D.G. & Scullion, H. (2008). The cross-cultural adjustment experiences of self-initiated repatriates to the Republic of Ireland labour market. *Employee Relations*, Vol. 30 Issue: 3. 270-275.
- Bhuiyan, S.N., Al-Shammari, E.S. & Jefri, O.A. (2001). Work related attitudes and job characteristics of expatriates in Saudi Arabia. *Thunderbird International Business Review* Vol. 43, Issue 1. 24-28.
- Bieniok, H. (2010). Rola zarządzania talentami w procesie budowy potencjału innowacyjnego organizacji. [w:] Jagoda H., Lichtarski J. (red.). *Kierunki i dylematy rozwoju nauki i praktyki zarządzania*. Uniwersytet Ekonomiczny we Wrocławiu. Wrocław. 114-116.
- Bombiak, E. (2014). Zarządzanie różnorodnością – wyzwaniem dla współczesnych menedżerów. *Zeszyty Naukowe Uniwersytetu Przyrodniczo-Humanistycznego w Siedlcach* Nr 102 Seria: Administracja i Zarządzanie. 113-115.
- Borkowska, S. (2005). Zarządzanie Talentami. IPiSS. Warszawa. 116-118. Bossard, A.B. & Peterson, R.B. (2005). The repatriate experience as seen by American expatriates. *Journal of World Business*, 2005, vol. 40, issue 1, 9-28. 33-35.
- Brzeziński, Ł. (2016). Zarządzanie talentami w organizacji. *Repozytorium Uniwersytetu Kazimierza Wielkiego w Bydgoszczy*. 128-130.
- Cartus (2014) *Global Mobility Policy & Practices*. Survey executive summary report.
- Cerdin, J.L. & Le Pargneux, M. (2010). Career anchors: a comparison between organization-assigned and self-initiated expatriates. *Thunderbird International Business Review*, Vol. 52 No. 4, pp. 288-290.
- Crowley-Henry, M. (2012). Re-conceptualizing the career development of self initiated expatriates: rivers not ladders. *Journal of Management Development*, Vol. 31 No. 2. 3-3. 1235-138.
- Dickmann, M., Suutari, V., Brewster, C., Mäkelä, L., Tanskanen, J. & Tornikoski, C. (2016). The career competencies of self-initiated and assigned expatriates: assessing the development of career capital over time. *The International Journal of Human Resource Management*. 6-7.
- Doherty, N., Dickmann, M. & Mills, T. (2011). Exploring the motives of company-backed and self-initiated expatriates. *The International Journal of Human Resource Management*, Vol. 22 No. 3, pp. 600-605.

Farndale, E, Scullion, H. & Sparrow, P.R., (2010). The role of the corporate HR function in global talent management. *Journal of World Business*, vol 45, no. 2, pp. 163-165.

Figura, A. (2016). Rozwój nowych technologii wymusza zmiany na rynku pracy. W branżach IT i marketingu pojawia się wiele nowych stanowisk i zawodów. <https://biznes.newseria.pl/news/rozwoj-nowych-technologii,p768265646>. [2018-06 01].

Froese, F.J. & Peltokorpi, V. (2013). Organizational expatriates and self-initiated expatriates: differences in cross-cultural adjustment and job satisfaction. *International Journal of Human Resource Management* 24(10), 1958–1960.

Hays Global Skills Index 2017 <http://www.hays.pl/gsi/gsi>.

Howe-Walsh, L. & Schyns, B. (2010). Self-Initiated Expatriation: Implications for HRM. *The International Journal of Human Resource Management*. 21. 265-267.

Inkson, K., Arthur, M. B., Pringle, J., & Barry, S. (1997). Expatriate assignment versus overseas experience: Contrasting models of international human resource development. *Journal of World Business*, 32. 352-354.

Kocór, M. & Strzebińska, A. (2010). Jakich pracowników potrzebują polscy pracodawcy?. *PARP*, Warszawa. 10-11.

Kubica, I. (2017). Rozprawa doktorska Uwarunkowana i efektywność adaptacji pracowniczej w międzynarodowym środowisku pracy, Kraków. 205-210.

Lazarowicz, A. (2017). Freelancer - czym się zajmuje i jak nim zostać? <https://poradnikprzedsiębiorcy.pl/freelancer-czym-sie-zajmuje-i-jak-nim-zostac> <https://poradnikprzedsiębiorcy.pl/freelancer-czym-sie-zajmuje-i-jak-nim-zostac> [2018.05.30].

Listwan, T. (2010). Zarządzanie talentami – nowy nurt zarządzania kadrami w organizacji. [w:] Jagoda, H., Lichtarski, J. (red.). Kierunki i dylematy rozwoju nauki i praktyki zarządzania. *Uniwersytet Ekonomiczny we Wrocławiu*. Wrocław. 125-130.

Lo, K, Won, I., Yam, R. & Whitfield, R. (2012). Examining the impacts of community and organization embeddedness on self-initiated expatriates: the moderating role of expatriatedominated private sector. *International Journal of Human Resource Management* 23(20), 4215–4218.

Makkonen, P. (2017). The employability of newcomer self-initiated expatriates in China: an employers' perspective. *Asia Pacific. Journal of Human Resources* (2017) 55, 500–505.

Mayerhofer, W., Sparrow, P.R. & Zimmermann, A. (2008). Modern forms of international working In: Dickmann, M., Brewster, C. & Sparrow, P.R. (eds), *International Human Resource Management: A European Perspective*, London Routledge pp. 220-223.

Mikuła, B. (2001). Elementy nowoczesnego zarządzania: w kierunku organizacji inteligentnych. Kraków: *Antykwa*. ISBN 83-87493-66-X. 29-31.

Miś, A. (2009). Zarządzanie talentami w organizacji. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie* Nr 810. 43-45.

Moczyłowska, J.M. (2014). Mentoring jako narzędzie zarządzania wiekiem. *Przedsiębiorczość i Zarządzanie* t. 15. 183-185.

Mróz, J. (2015). Zarządzanie Talentami – modele i podejścia badawcze. *Nauki o Zarządzaniu, Management of Sciences* 2(23). 95-97.

Peiperl, M.A. & Jonsen, K., (2007). Global Careers [w:] *Handbook of Career Studies*, ed. Gunz H. & Peiperl M.A., Sage, Los Angeles. 189-192.

- Peltokorpi, V. (2008). Cross-cultural adjustment of expatriates in Japan. *International Journal of Human Resource Management*, 19.1590-1592.
- Pocztowski, A. (2008). Zarządzanie talentami w organizacji. *Wolters Kluwer*. Warszawa. 42-45.
- Pocztowski, A. (2012) Znaczenie ekspatriantów w przedsiębiorstwie międzynarodowym [w]: Zarządzanie misjami zagranicznymi organizacyjne i indywidualne aspekty pracy ekspatriantów. Kraków, *Oficyna a Wolters Kulwer business*. 23-30.
- Przytuła, S. (2012). Ekspatriant – elastyczny pracownik międzynarodowy, Sukces w zarządzaniu kadrami Elastyczność w zarządzaniu kapitałem ludzkim Tom 1. Problemy zarządczo-ekonomiczne. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu* 248. 403-407.
- Przytuła, S. (2014). Zarządzanie kadrą ekspatriantów w filiach przedsiębiorstw międzynarodowych w Polsce. *Wydawnictwo CeDeWu*, Warszawa. 116-118.
- Purgał-Popiela, J. (2012). Różnorodność form międzynarodowej pracy i jej implikacje dla zarządzania zasobami ludzkimi. *Zeszyty Naukowe Uniwersytet Ekonomiczny w Krakowie*. 40-42.
- Richardson, J. (2009). Geographic flexibility in academia: a cautionary note. *British Journal of Management*, Vol. 20. 163-164.
- Richardson, J. & Mallon, M. (2005). Career interrupted? The case of the self-directed expatriate. *Journal of World Business*, 40(4), 411-414.
- Stahl, G. K. & Cerdin, J.L. (2004). Global careers in French and German multinational corporations. *Journal of Management Development*, 23, 885-902.
- Stahl, G.K, Miller, E.L. & Tung, R.L. (2012). Toward the boundaryless career: a closer look at the expatriate career concept and the perceived implications of an international assignment. *Journal of World Business*, 2002, vol. 37, issue 3, 216-227
- Steinerowska, S. (2015). Zarządzanie talentami jako czynnik sukcesu organizacji XXI wieku, <http://www.konferencja.edu.pl/Files/ConfXV/Reports/PDF/Steinerowska%20Sylwia%20%20.Zarządzanie%20talentami%20jako%20czynnik%20sukcesu%20organizacji%20XXI%20wieku.pdf>.
- Sullivan, S.E. & Arthur, M.B., (2006). The evolution of the boundaryless career concept: Examining physical and psychological mobility. *Journal of Vocational Behavior* Vol. 69, Issue 1. 297-299.
- Suutari, V. & Brewster, C. (2000). Making their own way: International experience through self-initiated foreign assignment. *Journal of World Business*, 35(4). 418-420.
- Tharenou, P. & Caulfield, N. (2010). Will I Stay or Will I Go? Explaining Repatriation by Self-Initiated Expatriates. *Academy of Management Journal* Vol. 53, No. 5. 1011-1013.
- Thorn, K. (2009). The relative importance of motives for international self-initiated mobility. *Career Development International*, 14, 5. 444-446.

Expectation Levels of Generation Y and Generation Z of their Employers and Superiors

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Abstract: The paper presents preliminary results of research on the expectations of employees from generation Y and generation Z. The author of the article presents a brief description of these generations, their motivations and expectations related to work. The aim of the paper is to present expectations towards potential and current employers and superiors.

Keywords: employee's expectations, generation Z, generation Y

1 Characteristics of the generation Y and the generation Z - generation falling into the labor market

Generation Y (millennials) includes people born from 1978 (or 1981/1982) to 1994 and have been described as edgy, urban focused and idealistic (Kotler 2005). This is the generation that grew up in times of peace and stable economic situation in Poland. As the same time this group was engaged in the end of the 21st century in the war on terror and Middle East conflict (Montana, Petit 2008). People, who were brought up in respect and tolerance of differences. Generation Y thinks and learns differently from the preceding generations, due in particular to the rapidly changing, highly technological environment in which they have been raised (Postolov, Sopova, Iliev 2017). This generation has not lived in a world without computers, the Internet, DVDs and mobile phones. This group is considered to be more process and less outcome focused (Crampton 2009).

This is the first generation that definitely draws attention to work-life balance. Making a lot of money is less important for them; instead their values are more oriented toward their contribution to society and their role as parents (Postolov, Sopova, Iliev 2017). They are self-confident, educated, convinced that the world is open to them. They are mobile and not seeing a problem in a possible change of job or position. Representatives of Generation Y attach great importance to the relationship and atmosphere in the team. More important than identification with the whole organization, is for them good cooperation with the boss and closest colleagues (Półtoraczyk 2017). This is the generation who can undergo career changes at least five times (Canberra Times, March 29, 2006). Nobody is surprised when they change their positions ten or more times. This generation is focused on self development (Kopertyńska, Kmiotek 2014)

Generation Z (Generation N, Net Generation) includes people born after 1995. They are also known as the Silent Organisation (Montana, Petit 2008). Generation Z will present profound

challenges to leaders, managers, supervisors, HR leaders, and educators in every sector of the workforce (Tulgan 2013). Initial interviews and analysis of questionnaires conducted with students born after 1995 show that they are people who have successfully entered the labor market. Among people in this age group there are people with even 6-8 years of professional experience. People from this generation work not only at the lowest organizational levels and at executive positions (salesman, waiter, sales representative, warehouseman, production worker), but also at specialist and managerial positions (IT specialist, mechanic, accountant, hotel manager, branch manager, HR manager or leader).

They are people brought up in times of huge development of technology and the Internet (eg. smart phones, laptops, freely available networks and digital media). They have been raised with social media, which is important part of their lives. Generation, who knows foreign languages very well, is aware of their own values and self confident. They enter the labor market with experience gained at foreign universities and internships in foreign organizations. They are not afraid of changes. Confident of their own worth and their skills, they are eager to look for new challenges, very often and without any problems changing their jobs. They attach great importance to the reputation of the organization. They are great at seeking information, so negative ones can discourage them to work in chosen organization (Półtoraczyk 2017).

2 Expectations and motivations of generations Y and Z

Motivating is a process of conscious and deliberate impact on the motives of people's behavior by creating means and possibilities to implement their systems of values and expectations to achieve motivating goals (Borkowska 1985). Motivating employees is aimed at mobilizing human resources and maintaining employee involvement on a permanent basis and high level (Wiśniewski, Luty 2016). Motivation can be considered as one of the management functions (Kopertyńska 2007, Oleksyn 2017, Przybyła 2003) or as a sub-function of human resources management (Listwan, Kawka 2010, Poczowski 2016).

To influence on employees, managers can use material and non-material motivating tools (Borkowska 1985, Gajdek 2014, Gruszczyńska-Malec 1999, Kopertyńska 2007, Tyrańska 2015). They can use the motivators proposed by the organization and included in the motivating system or motivating tools used by the managers who chooses them based on the individual needs of the team, their own preferences, or a specific situation (Półtoraczyk 2011). Knowing the specifics of the generation Y and the generation Z, managers can properly choose the motivating resources.

In order to effectively motivate employees of the generation Y, it is worth giving them as much freedom of action as possible, taking care of responsible and ambitious tasks and access to knowledge. Employees of the generation Y expect frequent feedback and attach great importance to the need for communication. It is worth setting specific precise goals for them, but not very long-term ones. Generation Y will be more willing to work when their salary will be linked to work results. They require interesting work, from time to time - new challenges. As part of the social package: sports packages or trips to cultural events will prove themselves,

but they are accustomed to receiving this type of benefits and they treat it as something obvious rather than a big advantage. For Generation Y making a lot of money is less important than their values connected with their families, but the absence of money might lead them to lose motivation (Karp 2002).

Generation Z is a new challenge for employers and managers. Representatives of the generation Z at work want to learn, but often prefer to perform interesting tasks over high pay. Development opportunities and promotion perspectives are important for them. They expect that in the future promotions will be associated with salary increases. The atmosphere, relations with colleagues and integration trips are important to them. They expect frequent feedback from the manager. They want to develop in international structures. It is worth engaging them in team projects, although they attach great importance to their individuality and independence, which manifests itself in the willingness to choose their form or working time (Bednarska-Wnuk 2012).

3 Research methods

The research questionnaire was designed based on literature research, and then it was supplemented with conclusions from conversations and initial suggestions obtained from students during discussions about expectations towards employers in 2017 and 2018. The questionnaire consisted of 3 questions plus questions about demographic aspects. In each of the questions, students were given tasks for assigning a sum of points (10, 20 and 10, respectively) to individual answers.

The condition for taking part in the study was having professional job experience. Students from the fields of study related to management at the University of Economics in Wrocław and the WSB University were asked to take part in the research. The questionnaire was distributed to the population of April period until May 2018.

90 people participated in the study, but 87 questionnaires were used for the analysis. As part of the study, 43 representatives of the Y generation and 44 representatives of the Z generation were analyzed. Due to a small research sample, the results can not be generalized to the population. The author sees the need to continue the research and to increase the size of the research sample.

4 Research results regarding expectations in relation to employers

In the first question, the respondents were asked to assess the significance of chosen values, at the time of selecting a new employer or at the time of consideration changing of work.

Answers show many similarities in the expectations of the generation Y and the generation Z. Preliminary results of the research show that for the representatives of both generations the most important value when considering the change of work is high salary basis, what is in line with the conclusions from literature research. The second most appreciated value by respondents are the career perspectives, which are more important for Generation Z. Next,

one can observe the first differences in the responses of representatives of particular generations. The third most important value for the representatives of the generation Y is employment stability, while for the generation Z is the possibility of getting qualifications. But the differences in answers are still very small. None of the students decided to point out other important issues that he takes into account when assessing a potential employer.

Table 1: The most important thing during choosing the employer.

The most important thing during choosing the employer						
	Generation Z		Generation Y		Generation Y + Z	
	sum	average	sum	average	sum	average
high salary basis	87	2,49	102	2,62	189	2,55
the career perspectives	67	1,91	62	2	129	1,95
the possibility of getting qualifications (training courses, studies financed by the employer)	45	1,61	50	1,61	95	1,61
employment stability	44	1,76	56	1,75	100	1,75
the possibility to work according to the interests	41	1,71	35	1,67	76	1,69
salary related to work results	40	2,22	45	1,73	85	1,93
the possibility of working in flexible time	34	1,62	27	1,42	61	1,53
additional benefits, eg mobile phone, laptop, company car, holiday financing, private medical care, season sports tickets	24	1,33	25	1,39	49	1,36
company's reputation - the company is recognized and appreciated on the market	16	1,45	11	1,22	27	1,35
the possibility of performing remote work (at home or another place)	14	1,27	11	1,38	25	1,32
the possibility to work according to the education	11	1,22	13	1,18	24	1,2
the possibility of receiving valuable bonuses for work (eg tours)	10	1,43	4	1	14	1,27
others:	0	0	0	0	0	0

Source: research results.

In the second question, the respondents were asked about what is the most important in assessing their current employer. Similarly to the evaluation of a potential employer, the most important id the amount of salary. In second value is good atmosphere at work. The third value for generation Z are the career perspectives. Generation Y prefers guarantee of job stability. A highly assesed values for both generations is independence at work, understood as the possibility to decide how to perform their own tasks. The values chosen by the representatives of both generations in the assessment of the current employer showed the first significant changes between the generation Y and the generation Z. For the representatives of the generation Y, highly assesed values are: guarantee of employment, the possibility of getting qualifications (training courses, studies financed by the employer) and rewarding for achieving the set goals. In turn, for representatives of the generation Z, highly valued

values are: clearly defined way of carrying out tasks, appropriate working conditions (tools, work environment) and than guarantee of employment stability.

Table 2: The most important thing during evaluation of the employer.

The most important thing during evaluation of the employer						
	Generation Z		Generation Y		Generation Y + Z	
	sum	avarage	sum	avarage	sum	avarage
amount of salary	117	3,77	133	4,03	250	3,91
good atmosphere at work	94	2,47	93	2,58	187	2,53
the career perspectives	70	2,26	61	1,97	131	2,11
independence at work, the possibility to decide how to perform their own tasks	50	2,27	51	2,22	101	2,24
clearly defined way of carrying out tasks	49	1,81	29	1,53	78	1,7
appropriate working conditions (tools, work environment)	47	1,62	36	1,57	83	1,6
guarantee of employment stability	43	1,72	65	2,5	108	2,12
salary related to work results	37	2,18	32	2	69	2,09
the possibility of working in flexible time	37	1,85	29	2,07	66	1,94
independence in performing tasks	29	1,45	21	1,4	50	1,43
the possibility of getting qualifications (training courses, studies financed by the employer)	29	1,71	53	1,96	82	1,86
the possibility of working in teams that allow to gain experiences	28	2,15	27	1,5	55	1,77
the possibility to work according to the interests	26	1,86	25	1,79	51	1,82
additional benefits, eg mobile phone, laptop, company car, holiday financing, private medical care, season sports tickets	25	1,67	31	1,63	56	1,65
the possibility to use your knowledge and skills at work	23	1,44	25	1,56	48	1,5
rewarding for achieving the set goals	22	1,38	40	2	62	1,72
new ambitious tasks are regularly commissioned	21	1,75	28	2,15	49	1,96
the possibility to share knowledge between colleagues	19	1,73	25	1,39	44	1,52
company's reputation - the company is recognized and appreciated on the market	17	1,42	10	1,43	27	1,42
the possibility of receiving valuable bonuses for work (eg tours)	13	1,3	5	1,25	18	1,29
the possibility of performing remote work (at home or another place)	11	1,38	10	1,25	21	1,31
the possibility to work according to the education	9	1,8	8	1	17	1,31
limitation of routine, repetitive tasks	7	1,17	13	2,17	20	1,67
others:	0	0	1	1	1	1

Source: research results.

In the third question, the respondents were asked what is the most important to them when assessing the supervisor. For the representatives of both generations, the most important values are clearly defined duties, tasks and goals. The sums of points in subsequent values indicate the differences. Significant values for the generation Z are encouragement to development and understanding in difficult life situations. Representatives of the Y generation, the remaining values scored significantly lower.

Table 3: The most important thing during evaluation of the supervisor.

The most important thing during evaluation of the supervisor						
	Generation Z		Generation Y		Generation Y + Z	
	sum	avarage	sum	avarage	sum	avarage
clearly defined duties, tasks and goals	57	1,68	58	1,93	115	1,8
encouragement to development	49	1,81	41	1,41	90	1,61
understanding in difficult life situations and support from the company	48	1,66	33	1,38	81	1,53
fair treatment of all employees	48	1,78	55	1,72	103	1,75
support in acquiring knowledge and skills	47	1,74	53	1,71	100	1,72
appreciating, praising	41	1,64	22	1,22	63	1,47
my supervisor has a lot of knowledge and skills in the field of work performed by the department	39	1,77	38	1,52	77	1,64
working with the employee to set goals	34	1,7	37	1,54	71	1,61
receiving systematic feedback on the evaluation of work results	31	1,41	33	1,43	64	1,42
my supervisor is interested in the needs and expectations of the team	31	1,41	32	1,6	63	1,5
my supervisor is a real leader	7	1,17	19	1,46	26	1,37
others:			7	3,5	7	3,5

Source: research results.

5 Conclusions

The results of the research show many similarities between the representatives of the generation Y and the generation Z. For both generations, the salary, career perspectives, self

development and independence at work are important. Both generations like to work with clearly defined duties, tasks and goals.

The limitation of routine, repetitive tasks, the possibility to work for valuable bonuses for work is of minor importance to representatives of both generations. It is not important to them if the boss is a real leader. The results of the study did not indicate any values that would significantly differentiate the generation Y and the generation Z. It can be concluded that working, ambitious, studing representatives of the generation Y and generations Z are very similar to each other. Managers of teams composed of representatives of these generations, can manage them similarly. They should pay attention to the clear definition of duties, tasks and goals, encourage their employees to development, should be just and empathetic.

Motivating systems in organizations employing representatives of Y and Z generations should include salaries related with work results, setting clear career prospects and guaranteeing employment stability.

References

Bednarska-Wnuk I. (2012). Elastyczność zawodowa w percepcji przedstawicieli pokolenia Y [w:] Witkowski S., Stor M. *Sukces w zarządzaniu kapitałem ludzkim*, Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu nr 249 tom 2.

Borkowska S. (1985). *System motywowania w przedsiębiorstwie*. Warszawa, PWN.

Crampton S., Hodge J. (2009). Generation Y: Unchartered Territory, *Journal of Business & Economics Research*, Vol. 7, No.4.

Gajdek G. (2015). *Motywowanie jako element procesu zarządzania zasobami ludzkimi w organizacji*, Wydawnictwo Uniwersytetu Rzeszowskiego.

“Generation Y takes over the Workplace,” (March 29, 2006) *The Canberra Times*.

Gruszczyńska-Malec G. (1999). Koncepcja systemu motywacji pracowniczej, *Ekonomika i Organizacja Przedsiębiorstwa* nr 5/1999

Iorgulescu M. (2016). Generation Z and its perception of work. *Cross-Cultural Management Journal*, Vol. XVIII, Issue 1 (9).

Jennings J. (2017). *Generation Z: Two billion people coming of age*. Source: [businessstoday.co.om /Issues/Top-companies-on-MSM/Generation-Z-Two-billion-people-coming-of-age](http://businessstoday.co.om/Issues/Top-companies-on-MSM/Generation-Z-Two-billion-people-coming-of-age) 8.05.2017.

Karp H. (2002). *Bridging the boomer — Xer gap: Creating authentic teams for high performance at work*, Davies-Black Publishing.

Kopertyńska M. (2007). Motywowanie pracowników sfery produkcyjnej – doświadczenia badawcze, *Zarządzanie zasobami ludzkimi* 3-4/2007.

Kopertyńska M., Kmiotek K. (2014). *Budowanie zaangażowania pracowników pokolenia Y*. Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu nr 358.

Kotler P., K. (2005). *Marketing Management*, Prentice Hall, Upper Saddle River, NJ.

Montana P., Petit F., (2008). Motivating generation X and Y on the job and preparing Z. *Global Journal of Business Research*, Vol. 2, No. 2.

Pocztowski A. (2016). *Zarządzanie zasobami ludzkimi*. Warszawa, PWE.

Postolov K., Sopova M., Iliev A. (2017). E-learning in the hands of generation Y and Z, *Poslovna Izvrnost Zagreb*, God. XI, BR. 2.

Półtoraczyk K. (2011). *Systemy motywowania w naukach o zarządzaniu oraz w polskich organizacjach*, Nauki o zarządzaniu. Zarządzanie w teorii. Prace naukowe Uniwersytetu Ekonomicznego we Wrocławiu nr 8.

Półtoraczyk K. (2017). Wyzwania w motywowaniu różnorodnych zespołów pracowniczych, W stronę różnorodności. *Od koncepcji do aktualnych problemów zarządzania*, Łódź-Warszawa, Wydawnictwo Społecznej Akademii Nauk.

Wiśniewski J., Luty E. (2016). Proces motywowania w organizacji, Zeszyty Naukowe Uniwersytetu Przyrodniczo-Humanistycznego w Siedlcach, Seria: *Administracja i Zarządzanie*, nr 108.

Differences in perception of quality of work life by employees of government institutions

Kamila Kuczaj

Abstract: This research aimed to investigate the perception of quality of work life by employees of three local government offices in małopolskie region in Poland. The results are based on quantitative data that was collected via questionnaire. The descriptive analysis were used to analyze the data. Based on these results, an in-depth expert interview survey was prepared to conduct interviews with managerial staff in the researched offices. The results, based on a regional probability sample of office workers revealed that employees' perceptions of quality of work life are similar in two offices but are different in the third one. The qualitative study of an elaborative nature, helped to get an insight into these differences. The author discusses the results and provides own answers to the questions regarding the substantial discrepancies between the three offices. No such integrated research on QWL has been conducted in Poland so far. The aim of the study was purely practical and had an intention of providing a valuable source of knowledge about the functioning of local government in Poland.

Keywords: quality of work life (QWL), perception of QWL, public sector, local government

1 Introduction

For the ancient Greeks work was a curse. In Greek, work was called *ponos* which means sadness. Latin *poeno* translates to punishment. For modern man, "ideal work has personal meaning and helps build self-esteem" (Manning, Kurtis, 1988). Studs Terkel writes that work is a search, sometimes successful, sometimes not, for "the everyday meaning and everyday bread." (Terkel, 1997). Work gives people a feeling of security because it lays out the everyday schedule and helps maintain stability. Therefore, it is important to create a work environment in a way which helps an individual find meaning and simultaneously, be a breadwinner. Research indicates that a high sense of well-being promotes determination and higher productivity in employees, in contrast with a low sense of well-being. (Akar, 2018). The effective use of human resources helps people perform well at work through the physical, mental and spiritual well-being of employees (Barnett & Brennan, 1998). Research shows that employees' well-being is affected by job specifications and quality of working conditions (Barnett & Brennan, 1998). Poor working conditions such as work overload, high pressure, excessive demands, lack of autonomy, lack of participation in decision making, low salary, lack of necessary tools to do work, low support from colleagues and supervisors, unfair treatment

and uncertain managerial approaches cause employees to experience uneasiness and stress. This in turn leads to both psychological and physiological health deterioration. Further negative consequences of a low level of well-being includes a decrease in: general well-being, job performance, organizational commitment, and an increased absenteeism, interpersonal conflict and work alienation (Akar, 2018). Therefore, it seems reasonable that today's organizations enhance their work environment to care for their employees' mental and physical health (Akar & Ustuner, 2017), and to provide conditions for revealing an individual's potential for finding meaning in work so it would not be associated with *ponos* and *poeno*.

2 Origin

Quality of work life (QWL) is a term better known to an average Norwegian than to an average Polish manager. The reason for this is not the number of scientific articles on quality of work life released in the country but the awareness of the issue among both employers and employees of organizations. As in the case of multiple management movements, this one also has its roots in the USA and Western Europe (Norway, Germany), yet, it has spread to Asia, Latin America, Central and Eastern Europe, including Poland. The reason for popularity of QWL has its humane and material nature. On the humane side, it promotes trust, fairness and mutual respect and puts man's dignity and morale as priority. On the material side, research has proved the more of QWL principles applied in a company, the better it operates (Lau, 2000)

Rapid economic development following the Civil War laid the groundwork for the modern U.S. industrial economy. There was an explosion of new discoveries and inventions. As industry grew larger, it developed mass-production methods. With these developments, an advancement in the human resources came along in the 1970s and 80s. It was manifested in a strong pro-quality movement that fought dehumanization in the workplace. The publication, "Where have all the robots gone?" discusses the omnipresent alienation, anxiety and frustration of the US workforce (Turner 1973). In a report by the US Department of Health, Education and Welfare in America in 1973, Senator Edward Kennedy raised the issue of worker alienation, which shocked the public due to evidence of psychological and physical violence in the workplace (Granter, 2016). Over the years the U.S.A labor market evolved, and with it came the employee value system and their needs at work. Finally, what advanced the QWL movement in the US, were the different work ethics represented by the new generation of "Baby Boomers." During this period of prosperity and upheaval, the "Baby Boomers" represented about 40% of the workforce. They brought new needs and expectations into organizations. The date quoted by many authors as the official start of QWL is September 1972 when the definition *quality of working life* was coined by Davis at a "Democratization of Work" conference held at Columbia University Arden House. The QWL movement picked up soon after. In the 1980s America's trade deficit swelled as low-priced and frequently high-quality imports of goods from automobiles to steel to semiconductors flooded into the United States (The U.S. Economy: A Brief History, Lowe 2001). A decade later, businesses were already beginning to recognize the principle that high quality personnel would allow maintenance of

their competitive advantage, rather than capital, technology, or durable goods (Caudron 1994).

Today we know that QWL aims to improve the quality of employee experiences in the workplace so as to boost organizational and individual performance. From an organizational perspective, QWL is important, since there is evidence that the nature of the work environment is related to the satisfaction of its employees and their work-related behaviors (Greenhaus et al. 1987). QWL is also found to effect employees' work attitudes, which are reflected in organizational identification, job satisfaction, job involvement, effort and performance, intention to quit, organizational turnover, and personal alienation (Chan, Wyatt 2007). In a review of the literature on work health and well-being, there is a link between those who experience greater QWL and higher levels of health and well-being (Danna, Griffin, 1999). Conversely, other work-related behaviors such as absenteeism, reduced productivity and efficiency appear to be affected by a low level of QWL (Marks et al. 1986).

3 Definitions

The concept of QWL may be equaled to a groundbreaking way of thinking, a philosophy, and a trend toward a change in mentality that has, for years, divided workers into supervisors and subordinates. As the direct dialogue was limited, trade unions served as a forum of communication, particularly for dispute resolution. QWL gave rise to the humane treatment of workers, and led to the acceptance of basic humanitarian principles that addressed the needs and expectations of an employee. Ultimately, QWL sparked an interest in respect for the individual's dignity, morale and values in the workplace.

Beginning in the 1970's, various definitions of QWL have emerged in the literature (Beh, Raduan, 2007). Principally, these definitions of QWL include: a repair program, overall well-being at a workplace (overall quality of experience), a process or philosophy. As a repair program, QWL is a human resources management tool that focuses on the needs of employees to reach the organization's goals. As a process, QWL embraces the actions that aim to improve the functioning of an employee in the organization and, at the same time, to boost the organization's performance. As a philosophy, QWL is a way of thinking and an approach to the employee that has been shaped over decades, and today is a part of organizational culture and people's mentality. As an overall well-being, it is a set of experiences that reflects the employee's perception of the quality of functioning in various spheres of work. Table 1 lists classical and modern definitions of QWL.

Table 1. QWL definitions

Hackman and Oldham, 1973	Overall wellbeing (set of experiences). Quality of work life is influenced by psychological factors. Work environment, which can contribute to fulfilling the personal needs of employees, such as development of diverse skills, task identification, task significance, autonomy and feedback, can provide a positive interaction effect, which will lead to a high level of QWL. The crucial QWL aspects include: pay, promotion, recognition and personal development.
Taylor 1973 and Sink, 1975	Quality of Work Life as "the degree of excellence in the work and working conditions which contribute to overall satisfaction of the individual and enhance individual as well as organizational effectiveness".

Davis, 1977	QWL equals quality of the relationship between an employee and his working environment as a whole
Nadler and Lawler, 1983	QWL equals nothing. "The inevitable failure of some QWL projects (to be expected in any innovation) and QWL's inability to deliver on some of the promises made will make the skeptics who went along with it only grudgingly turn against the concept."
Seashore, 1988	QWL is the efficiency in the performance of specific roles in the workplace. Three areas of the work environment should be considered here: related to the employer, the employee and the community. From the point of view of the employer, QWL equals efficiency, productivity, production costs, and product quality.
Cunningham et al., 1990	task, the physical work environment, social environment within the organization, administrative system and relationship between life on and off the job
Heskett et al., 2008	It is a visible expression of an organization's culture, one influenced in important ways by leadership.
Gupta and Sharma, 2011	QWL is a holistic program designed to improve employee's satisfaction, strengthening workplace learning and helping employees to better manage change and transition.

Source: own work based on "Meaning of quality of worklife. Factors and barriers to development of QWL in Polish local government" (PhD thesis, Kuczaj, 2017)

4 Purpose of the study

The purpose of the study was to present the differences in perception of quality of work life by employees of local government institutions in Poland and to show how a group of organizational and socio-psychological factors influence the perceived quality of work life.

5 Methodology of the study

The research reported in this article is a part of the author's doctoral study, which was conducted in four stages. As an introduction to the empirical research, the author thoroughly reviewed the literature on the subject; extended knowledge about the subject allowed the construction of the scheme of the empirical study. Its first stage was carried out in 2013, and was the initial design and pilot test of a research tool. The pilot study's purpose was to better understand the issue of QWL in the workplace of employees from the public sector. It asked respondents from the public and private sector (n=90) to rank the job aspects from most to least important on a Likert scale. The scale included 11 items: adequate and fair compensation, system of rewards and punishments; fringe benefits, stability of employment, physical working conditions and safety at the workplace, working hours, low level of stress in the workplace, opportunities for continuous improvement, education and development, social aspect – relations with the employer and colleagues at work, participation in decision-making, independence, autonomy, variety of tasks, creative and challenging work, equal treatment, an counteracting violence/abuse (Walton, 1974). It should be noted at this point that the main problem in using Walton's "Eight-Factor Model" is its lack of a detailed description of particular components, and the overly sophisticated description that makes it cumbersome to understand for both practitioners and theorists. Based on Walton's QWL model, and the results of the pilot study (which included selection of the most important job aspects), the author created a questionnaire asking about the ten most important QWL determinants. This questionnaire was distributed to employees at three offices included in the research study in 2015. The first stage of the study helped the author to determine the

major influencers on QWL. The second stage served as a tool for improving the research instrument (questionnaire). The third stage of the research (which was the main focus of the study) was conducted between January and February 2016. It involved administering the revised research instrument to a stratified sample (n=227) from three local government institutions at the county level: Nowy Targ, Limanowa, and Nowy Sącz. To maintain privacy, in the section Results the offices are named randomly as office X, Y and Z. The respondents represented all organizational levels: administrative, managerial, interns, and independent contractors. To keep confidentiality, the completed questionnaires were returned separately in sealed envelopes. The research instrument was addressed to all employees of the investigated offices, Non-probabilistic purposive sampling was used. The QWL portion of the research instrument consisted of four questions, demographics, and open- and closed-ended questions. There were 72 items in the questionnaire on QWL. The respondents were asked to express their views on the various statements in a Likert scale (“I strongly agree”, “I agree”, “do not know”, “disagree”, “strongly disagree”). Finally, the respondents were requested to state their gender, age, marital status, education, work tenure, and work position.

The nature of the research is determined by the fact that the study of the entire population could be difficult, so in this case a test sample was selected for the study. Non-probabilistic purposive sampling was used for the sample. The author had prior knowledge of the studied population and the objectives of the study. This knowledge resulted from personal experience via work in a marshal’s (marszałek) office, as well as several years of close cooperation with a county office as part of the author’s professional activity.

The fourth stage of the empirical study was qualitative. The author conducted expert interviews with the managerial staff including county executives (starosta). This qualitative analysis sought to ask how the respondents perceived QWL, what QWL means to them, what they most like about their job, the status that their work has in their life, if they like their job, and how they imagine their future career path. They were also queried about any flaws in their workplace.

6 Researched population

23% of all working Poles are employed in the public sector, which is about one million people (of which 444 thousand work in public administration and 260 thousand are employed in local “self-government”) (“W Polsce wzrasta liczba urzędników”, 2015). There are 314 ‘powiaty’ (districts/counties) in Poland and 66 cities with a ‘powiat’ status. The survey was conducted between January and February 2016. The respondents were employees of three districts: Limanowa, Nowy Targ and Nowy Sącz; 227 office staff employed in three local government offices participated in the research. In total, 360 questionnaires were distributed (the number was made up of the office workers delegated by the heads of the offices). There was a 63% response rate (N=227), 70% of the respondents were female and 30% male. The majority (68%) were young and middle-aged (26-45-years-old). Only 8% of younger people (under 25) participated in the study. The majority (87%) of the respondents had completed higher education. There were no people with education lower than secondary school. Most of the

studied population lived with their family (83%); and 63% of the respondents had over ten years of tenure (7% had less than two years of tenure). Most employees were administrative staff (74%) and 9% were in managerial positions.

Based on the author's knowledge and experience, it was presumed that public administration employees are a specific research sample. The organizational climate that prevails at county offices is different from the climate in private companies, and motivational factors are also different. Therefore, the QWL research tool is adapted specifically for the needs of such a research object. The three selected offices are demographically and structurally similar. They are located in the Małopolskie voivodship and are distant from a large urban center by about 65–75 km. They are located in towns not exceeding 50,000 residents. The ratio of employment structure (urban vs. rural) is similar in all three places. In the following part of the paper, the study results of all three offices are presented separately for each office.

7 Results

The responses of employees from office Y and Z to individual questions regarding compensation do not differ significantly. However, a difference can be noticed in the responses of offices Y and Z compared with the office X. Their employees agree with positive statements regarding justice and stability of compensation as well as sufficient pay. It can therefore be concluded that they are more satisfied with the issues related to their compensation than the workers from the other two offices. City X is a city with a smaller population than cities Y and Z. Living costs in X are slightly lower than in other cities. However, this should not significantly affect satisfaction from salary. The answers obtained in the in-depth interview indicate a generally better level of job satisfaction and quality of work life in office X. This satisfaction may translate into satisfaction with particular aspects of work. From observations during interviews, it can be stated that in office X there is a nicer atmosphere (compared to other offices) and employees have a better contact both with each other and with their supervisor, including the mayor. In the expert interviews the employees mentioned that their employment in the office is not motivated by finances, because, as they claimed, they realize the limitations of compensation in public sector, and specifically at the local government office. However, as some pointed out, they can count on financial rewards for good results at work. Worthy of note, only the employees of the office X indicated such answers. It can be implied that this overall job satisfaction translates into satisfaction with particular work aspects and the perception of the employer. Table 2 presents the respondents' responses on the discussed issue of compensation with a division into three researched local government offices.

Table 2. Responses on the issue of compensation.

Question	Office X		Office Y		Office Z	
	Agree	Do not agree	Agree	Do not agree	Agree	Do not agree
My salary is sufficient to cover my basic and / or my family's basic costs. Other people in our office at a similar work position and with similar qualifications as mine earn more than I do.	69,7%	24,2%	57,1%	41,9%	47,3%	47,3%
My job gives me permanent employment and stable income.	88,1%	6,0%	76,2%	12,4%	85,5%	7,3%
I think that I am fairly rewarded compared to my colleagues (taking into consideration my competences).	66,7%	21,2%	53,4%	38,8%	58,2%	36,4%
Other people in our office at a similar work position and with similar qualifications as mine earn more than I do.	31,3%	21,9%	44,7%	29,1%	49,1%	35,8%
At work, it's bothering me that I cannot count on a pay rise.	25,4%	47,8%	55,3%	24,3%	61,1%	24,1%

In the case of social climate, the largest differences in responses are between the respondents from offices X and Z. In the first one, majority agreed with statements about positive relations with supervisors, colleagues at work and councilors. The percentage of people who disagreed with negative claims was also higher. The major differences between the two offices concerned questions: My supervisor often helps me when I face problems at work and I am praised for a well done job. Most often, the employees of office X are praised verbally. Such a situation is, according to the researcher, a consequence of the atmosphere prevailing within organizations. It depends mainly on the directors of the departments and the mayor. Despite the fact that in interviews only in office Z in 2 departments, the directors complained about poor cooperation and lack of obedience of their employees, all other interviewees expressed a positive opinion about cooperation between colleagues. Regarding contact with the mayor, the answers were completely different in each office. In office X, the interviewees referred to him as "boss", and in the other two offices, they addressed them as mayors. It is probably due to a better contact with employees of the offices. What's more, the directors in office X spoke about their mayor with great respect. They said he is a person with democratic leadership qualities and that he listens to their comments which he sometimes puts into practice. In office Z, however, the directors said they could speak to the mayor, but he rarely took their opinion into account when making decisions about the functioning of the office.

Table 3. Responses on the issue of social climate.

Question	Office X		Office Y		Office Z	
	Agree	Do not agree	Agree	Do not agree	Agree	Do not agree
My supervisor often helps me when I have trouble at work	92,50%	3,00%	86,50%	6,70%	77,80%	13,00%
I have a good relation with my supervisor	98,50%	0,00%	95,20%	1,90%	94,30%	1,90%
It happens that my supervisor criticizes me at work	19,70%	47,00%	41,00%	40,00%	30,20%	50,90%
My supervisor's opinion is valuable to me	95,20%	0,00%	90,90%	5,10%	88,70%	5,70%
My supervisor rarely helps me when I have problems at work	12,30%	70,80%	19,00%	69,00%	18,50%	61,10%
My supervisor gives me clear orders	91,00%	3,00%	88,50%	10,60%	84,30%	13,70%
Sometimes I have trouble understanding what my supervisor wants from me	14,90%	61,20%	22,30%	56,30%	27,80%	46,30%
I have good relations with my coworkers	100,00%	0,00%	93,30%	4,80%	98,10%	0,00%
I can often count on my colleagues help at work	98,50%	1,50%	95,20%	1,90%	94,50%	1,80%
I am praised for a well-done work	71,20%	13,60%	59,20%	21,40%	46,30%	29,60%
I like my supervisor	91,00%	0,00%	85,10%	7,90%	90,60%	0,00%
Professional contact with my supervisor is direct and close	62,50%	12,50%	50,50%	24,30%	58,20%	21,80%
I can never count on my coworkers help	0,00%	89,60%	2,90%	78,10%	1,80%	80,00%
I have good friends at work	89,60%	1,50%	80,00%	11,40%	75,50%	7,50%
My work is recognized by the supervisor	74,60%	7,50%	74,00%	18,00%	60,40%	22,60%
My supervisor rarely helps me when I have problems at work	6,00%	77,60%	11,50%	76,90%	16,40%	69,10%
I can always count on my coworkers' help	93,90%	3,00%	94,20%	2,90%	89,10%	9,10%
My relations with councilors are good	54,50%	1,50%	47,60%	3,90%	38,20%	7,30%

Due to the fact that development is the factor that has the greatest impact on QWL and job satisfaction in the researched offices (Kuczaj, 2017), and because the answers in the questionnaire were very different among the three offices and unfavorable in the office Z, one question in the in-depth interview was devoted to this issue. In the questionnaire employees from the office Y had more development opportunities than their colleagues from office Z. They also appreciated the practical subject of trainings, and the organizational rules of access to training. In turn, the employees in office X, most of the surveyed offices, appreciate all aspects of professional development. In offices Y and Z, the employees spoke positively about the access to training, they claimed that "if you want to participate, there is no problem". However, as it is typical in the public administration, training mainly concerned changes in legal regulations. These employees had no access to training in soft skills. In contrast, office X, a few years earlier, participated in an EU project which financed postgraduate studies for

those who wanted to participate. In office Z, several directors complained about access to training, they said that sometimes they had to negotiate the price with the organizer as they had limited budget. One reviewee described one such situation and said it was "embarrassing". Director of one of the departments also mentioned there was a lack of financing for employee training and said that they purchased a subscription for one person in a training company, which was later used by others from the department so that more people could take advantage. At the office Y and X, none of the directors mentioned such a problem. These responses confirmed and elaborated the issues indicated in the questionnaire.

Table 4. Responses on the issue of growth and professional development

Question	Office X		Office Y		Office Z	
	Agree	Do not agree	Agree	Do not agree	Agree	Do not agree
Work creates conditions for my professional development	83,60%	10,40%	59,60%	22,10%	54,50%	23,60%
At my work , I cannot develop	6,10%	75,80%	17,60%	62,70%	21,80%	50,90%
In comparison to other offices in the region, my work creates better conditions for me to develop	67,20%	12,50%	52,00%	30,60%	29,60%	46,30%
The subject of training is usually interesting and useful at work	66,70%	19,70%	61,50%	14,40%	35,80%	30,20%
The knowledge gained during the training I often use at work	74,20%	13,60%	67,00%	12,60%	42,60%	24,10%
The rules for access to training and other forms of education are clear	88,10%	6,00%	64,40%	27,90%	49,10%	35,80%
At work, I carry out various tasks, I work on various projects, etc.	79,10%	7,50%	58,70%	17,30%	73,60%	11,30%
I can choose the training in which I want to participate	64,20%	11,90%	56,70%	18,30%	47,30%	27,30%
Lack of promotion opportunities does not encourage me to work at my fullest potential	16,40%	59,70%	55,90%	30,40%	43,60%	40,00%

The worst physical working conditions were reported by employees in office Y (76% rated them good) and the best in office X (93% employees thought they were good).

According to in-depth interviews, respondents from office Y have no reason to be satisfied with social and technical infrastructure. This is due to the fact that the building in which the office is located is protected by the historic preservation office, as one of the interviewees informed during the interview. The building looks impressive outside, but inside the conditions resemble the old communist Poland. There is no air conditioning in any of the office buildings. What improves work between departments is one location as offices X and Z have. Office Y is located in three buildings which, as explained by the interviewees, makes communication difficult.

Respondents' answers to questions regarding decision-making were similar in the case of offices Y and Z. The only exception was the question "I can participate in decision making on some matters related to the department". In addition, employees from office X perceived

their decisiveness at work better than others. The issue of participation in decision making about the department appears unfavorably for office Y. The interview revealed the reason for this situation. The office was undergoing structural changes as a new mayor took over the office. The directors mentioned that they are not allowed to make many decisions that they earlier could. In the interview the mayor explained he required more control over all departments as there were many flaws when he stepped into the office which he wanted to eliminate.

Table 5. Responses on the issue of decisiveness

Question	Office X		Office Y		Office Z	
	Agree	Do not agree	Agree	Do not agree	Agree	Do not agree
I have the freedom to express my opinions	86,40%	6,10%	75,20%	14,30%	75,90%	14,80%
I can take part in decision-making in my department	67,20%	10,40%	37,50%	27,90%	65,50%	20,00%
My superior gives me freedom as to how to perform my duties	89,60%	4,50%	74,30%	12,90%	79,60%	7,40%
My supervisor takes into account my opinion on various issues related to work	80,60%	3,00%	72,10%	13,50%	74,50%	12,70%

The respondents from office X provided positive answers to all questions regarding fair treatment by on average 23 percentage points higher than the respondents from office Y and by 32 percentage points higher than those from office Z. The discipline is evaluated better again in office X, although all offices appeared well in this area. The statement "all employees are treated fairly" arouses the most controversy in the case of office Z. It is probable that employees had in mind "unfair compensation". It was found from the interviews, the mayor in office Z introduced a system of compensation based on job evaluation. Most of the interviewed directors stated that for them and their employees it was unfair because even though for most of them it meant a pay rise, this increase in compensation was not equal and fair for all employees. This might have been the reason for poor responses about the matter of fairness in office Z.

Table 6. Responses on the issue of equal treatment

Question	Office X		Office Y		Office Z	
	Agree	Do not agree	Agree	Do not agree	Agree	Do not agree
All employees are treated fairly	71,20%	16,70%	48,50%	45,60%	37,70%	43,40%
At work I am treated equally	89,60%	7,50%	64,10%	27,20%	59,30%	35,20%
I am satisfied with the discipline at work and think that I am treated justly here	88,10%	4,50%	66,00%	24,30%	56,40%	29,10%

Communication at work received best evaluation by the employees of office X. They agreed with positive questions about communication on average by 13 percentage points higher than respondents from office Y and by 26 percentage points higher than respondents from office Z. The mayor in the office X supports an open dialogue with his employees, which serves as a model for the managerial staff. In the other two offices the mayors represent different management styles, one being autocratic. In all offices, the intranet platform is used to distribute information relevant to the office to all employees. There are also departmental meetings to inform employees about important issues. Both these channels of communication were rated as effective in the interviews.

Table 7. Responses on the issue of communication

Question	Office X		Office Y		Office Z	
	Agree	Do not agree	Agree	Do not agree	Agree	Do not agree
Generally, information about what happens in the office gets to me quickly	68,70%	19,40%	53,90%	37,30%	46,30%	38,90%
The flow of information at the office is smooth, I usually know about important matters in other departments	64,20%	20,90%	52,90%	38,50%	35,20%	50,00%

In the questions about stress the answers were similar in all three offices. The exception was the answer to the statement "I have the impression that my work is constantly controlled", to which there were 25% of positive answers in office X, 36% in office Y, and 54% in office Z. An in-depth interview indirectly pointed to the cause of such a problem. The reason might be the autocratic management style by the mayor in office Z. This type of leadership may have manifestations in the increased control of employees.

Table 8. Responses on the issue of stress

Question	Office X		Office Y		Office Z	
	Agree	Do not agree	Agree	Do not agree	Agree	Do not agree
I do not feel stressed doing my daily job duties	67,20%	23,90%	64,40%	30,80%	59,30%	35,20%
Sometimes the work is too stressful	61,10%	30,50%	61,10%	30,50%	61,10%	30,50%
I have the impression that my work is constantly controlled	25,40%	53,70%	35,60%	40,40%	53,70%	35,20%

In office X, the respondents assessed ethics in the workplace better than their colleagues from other offices. There were no significant differences between places Y and Z. Unfortunately, interviews with the managers did not help in obtaining more information on the subject. It can be deduced that since other important work aspects such as interpersonal relations, justice or communication are assessed poorly in office Z and the degree of control is high

there, employees have less trust in coworkers, which affects negatively the perception of one another and their employer.

Table 9. Responses on the issue of ethics

Question	Office X		Office Y		Office Z	
	Agree	Do not agree	Agree	Do not agree	Agree	Do not agree
The place in which I work has high ethical standards	79,10%	9,00%	65,40%	26,00%	53,70%	33,30%
Sometimes I have the impression that I can be cheated by someone at work	17,90%	53,70%	34,30%	47,10%	38,90%	40,70%

Respondents from all offices answered similarly to the question about the mission of the organization. Nearly 90% of employees in all three offices agreed with the statement "I feel that I am doing my job for a specific purpose, I know the mission of the organization".

In the literature on the subject, there are many opinions that public administration employees are guided by the mission of service. In the researched offices, such a philosophy dominates as well. It was especially evident during interviews with the mayors. They emphasized that it is important to help the public and that the motivating factor for them is good opinion among the local community, which is the result of the local government activities. Two of the mayors indicated that they delegate this mission to their employees and try to shape their friendly and helpful attitude towards the clients. In one of the interviews in office X, the interviewee mentioned that a small group of employees (about 10%), which still has the communist approach that the constituent should strive to be assisted at the office. As mentioned by the interviewee, this incidence is minor, yet, the mayor still "struggles and fights this attitude".

8 Discussion and implications

The responses of the employees of three offices in the questionnaires and expert interviews clearly show that the best-managed office is office X. It was the only institution, among the researched ones, that received a 9001 quality certificate. The mayor of the office X, who prior to the current position, was a successful business person, has the right skills for selecting the staff for managerial positions. As research shows, salary can help attract new talents, but to maintain these talents within an organization, investment in creating a positive culture and value, improving the quality of senior management and creating career paths are necessary. According to the principles of TQM, full participation of the top management is important for a company to operate effectively and especially to introduce changes. Therefore, the managerial staff is largely responsible for retaining valuable employees. The mayor at this office employed young management staff who are involved in their duties and have the competence to manage teams. In contrast to the old model of autocratic management, the directors at this office employ a democratic style. Based on the responses from quantitative and qualitative study, it was deduced that the success of the office X is highly dependent on the people at the management level, as well as, of course, the very figure of the mayor, who

boldly posts these positions. In Poland, when holding a public office, it is hard to make staffing decisions individually.

One of the main conclusions regarding barriers to the development of QWL in the researched local government offices is that people in management positions are the key element of an effective organization. Therefore, the recruitment process for these positions plays an important role. Directors who manage their departments well, are able to motivate their team, organize its work, ensure the development of the employees and assign them duties relevant to their competences, so that they can decide about their work and participate in department decision-making. An important conclusion that emerged from the qualitative research was that the director should not be a person who has only the knowledge necessary to take a given position, but one that has additional skills that make them effective human resource managers. The director at the office should skillfully manage careers, exercise empowerment - assign greater responsibility to employees, treat people fairly and ethically and communicate well inside and outside of their department, and finally use feedback. As this research reveals, these practices may greatly support the development of QWL or become its limitation, as it is in the case of the studied offices. Final conclusion of the study is that introduction of a comprehensive employee opinion survey on subjective and objective aspects of work in local government offices will constitute a substantial contribution to theoretical and practical knowledge in the field of management in local government. The major implication of this study is that it would be valuable to conduct a comparative research in other European counties which adopted a similar economic and political systems, so it would serve as a benchmark. Even more interesting would be a comparative study in a country where different systems dominate. In the closing lines, it is important to mention the limitations of the present study. It is not a behavior but an attitude study, and as such it is only suggestive of what type of practices are desirable to increase the level of QWL, which would ultimately lead to a more effective operation of an organization. The nature of the sample also incurs some problems. Although large, it is not a random sample and because of this the implications with respect to the desired QWL practices must be considered suggestive not definite.

Bibliography

Akar, H., & Üstüner, M. 2017. *Mediation role of self-efficacy perceptions in the relationship between emotional intelligence levels and social entrepreneurship traits of pre-service teachers*. Journal of Education, (12), pp.95-115

Akar, H. 2018. *The Relationships between Quality of Work Life, School Alienation, Burnout, Affective Commitment and Organizational Citizenship: A Study on Teachers*. European Journal of Educational Research, 7(2), pp.169-180.

Barnett, R.C., Gareis, K.C. and Brennan, R.T., 1999. *Fit as a mediator of the relationship between work hours and burnout*. Journal of occupational health psychology, 4(4), p.307.

Beh L.S., Raduan Ch.R., 2007, *Linking QWL and job performance: Implications for organizations*, Performance Improvement, 46.6.

Caudron S., 1994, *De-jobbing of America*, Industry Week 243(16), pp. 30-36.

- Chan K.W., Wyatt T.A., 2007, *Quality of work life: a study of employees in Shanghai, China*, Asia Pacific Business Review, 13(4).
- Danna K., Griffin R.W., 1999, *Health and well-being in the work-place: a review and synthesis of the literature*, Journal of Management, 25(3), pp. 357-384.
- Granter E., 2016, *Critical social theory and the end of work*, Routledge.
- Guzda H.P., 1984, *Industrial democracy: made in the USA*, Monthly Lab. Rev., 107.
- Greenhaus J., Bedian A., Mossholder K., 1987, *Work experiences, job performances, and feelings of personal and family well-being*, Journal of Vocational Behaviour. 31(2), pp. 200-215.
- <https://usa.usembassy.de/etexts/oecon/chap3.htm> 8 June 2018.
- http://www.presidency.ucsb.edu/economic_reports/1978.pdf, 15 Aug 2017.
- <http://www.regiozet.pl/monitor> 2014, 15 Aug 2017.
- <https://www.nlr.gov/sites/default/files/attachments/basic-page/node-1677/nlr1978.pdf>, 20 Sept.
- http://wiadomosci.wp.pl/kat,140714,title,W-Polsce-wzrasta-liczba-urzednikow-Jest-ich-juz-ponad-444-tysia-ce,wid,17527914,wiadomosc.html?ticaid=1177e6&_ti-crsn=3, 19 Feb 2016
- Kuczaj K., 2017, *Meaning of quality of worklife. Factors and barriers to development of QWL in Polish local government*, Jagiellonian University, Krakow.
- Lau, Ronald SM., 2000 "Quality of work life and performance—An ad hoc investigation of two key elements in the service profit chain model." International Journal of Service Industry Management 11.5 p. 422-437.
- Lowe G.S., 2001, *Quality of Work—Quality of Life*, Keynote address to the "Work/Life Balance and Employee Wellness Strategies" Conference, Edmonton.
- Manning, George, Curtis, Kent. 1988 *Morale: quality of work life*. VistaSystems, p.6-9
- Ranking powiatów powyżej 120 tys. mieszkańców 2017, <http://ranking.zpp.pl/index.php?action=ranking&ctl=ranking\Main&id=3>, 14.08.2017.
- Terkel, Studs, 1997, ed. *Working: People talk about what they do all day and how they feel about what they do*. The New Press.p.9
- Turner A.N., 1973, *Where have all the robots gone? Worker dissatisfaction in the 70S*, Administrative Science Quarterly, 18.3, pp. 414-416.
- Walton R.E., 1974, *Improving quality of work life*, Harvard Business Review, 52.3.

Intellectual Capital and Asset Dynamics

Aino Kianto and Agnieta Pretorius

Value creation is increasingly based on leveraging intangibles, but firms lack knowledge and skills on identifying, measuring and managing their intellectual capital. Also the existing academic literature on knowledge-based value creation seems to have concentrated on either IC stocks of firms or their management mechanisms (cf. Kianto et al. 2013). To produce a more complete picture of the tenets of organizational performance in the knowledge economy, this track examines both issues: IC stocks and knowledge management practices.

Intellectual capital reporting in universities as a tool of accountability – the worldwide practices

Justyna Fijałkowska, Dominika Hadro and Łukasz Sułkowski

Abstract: Universities worldwide are going through the important transformation processes aiming to make them more autonomous, economically efficient and competitive. However, at the same time they have to prove efficient resource management, disclose properly their outcomes, and demonstrate high level of transparency and accountability in support of clearly defined and feasible goals. One of the main approaches to the assessment of performance, ensuring control and promoting accountability in the universities has become intellectual capital reporting. The first objective of this paper is to present the accountability request geared towards universities and IC measurement and reporting as the answer to it. The second one is the review and discussion of the qualitative and quantitative empirical research in IC reporting of universities worldwide. The conclusions of the research confirm that the practical implementation of IC reporting in universities is still a challenge for a practice. The pioneer initiatives concerning application of IC reporting in universities are important steps towards greater accountability; however they lag behind the needs of stakeholders and should be improved in order to be more comprehensive, comparable and systematic. Greater awareness and effective implementation of IC reporting in universities could improve their future potential, quality and competitiveness.

Keywords: Intellectual capital, reporting, accountability, worldwide practices

1 Introduction

During the last decades, the growing interest regarding intangibles and intellectual capital (IC) has extended from firms to public institutions, such as universities. Universities play an important role in the society: they are essential partners of the knowledge creation and knowledge exchange networks, catalyst of innovation, suppliers of tangible outputs of research results, institutions providing consulting and advisory services. Knowledge in universities represents both the input and the output of their activities. Intellectual capital serves as a key resource for those institutions. Moreover, nowadays universities are facing an increasingly competitive environment in which they operate. There are also growing expectations placed on universities by their stakeholders that request accountability for funds spending and university outcomes. Intellectual capital reporting could be an important tool of the improved internal management of universities and in the same time a tool of communication, transparency and accountability for external purposes.

The objective of this paper twofold; on one hand, to present the accountability request geared towards universities and IC measurement and reporting as the answer to it, the second is to

review and discuss the qualitative and quantitative empirical research in IC reporting of universities worldwide.

The resources theory, stakeholders' theory, legitimacy theory, and signaling theory as well as the New Public Management (NPM) and post-NPM concepts gave the foundation of this research. It also falls in line with the call of Bisogno et al (2018) that 'IC in education needs to expand its boundaries so it does not lose its relevance, and thus be able to contribute to wider policy debates'.

This paper contributes to IC literature by providing an assessment of accountability requests toward universities and the comparison of IC voluntary disclosure practices by universities. . It provides an insight into the findings of early adopters of the IC reporting concept in universities from eight different countries worldwide.

The analyzed IC reporting practices may have two main practical implications: they may be used as an internal management tool, aiming at improving the performance of universities' management processes and may play a role of the external accountability tool, legitimizing the universities' activities and outcomes. The results of comparison of practices give important directions for future development of the concept of IC reporting by universities.

2 Accountability of universities – the increased need for transparency

Universities are operating in a rapidly-changing environment, as societal, technological, economic, ecological and political developments force them to adopt flexible structures that can adapt quickly to new demands (Sporn, 1999). The decision-making processes in universities have become increasingly complex (Leja, 2013, p. 21). The development of knowledge economy and the growing turbulence and uncertainty in the environment of modern organizations impact also universities. There is a lively debate about how universities should be managed that is intensified by the following factors (Elena-Perez, 2011):

- changes in the funding modes of universities (OECD, 2007; CHINC Project, 2006),
- increasing levels of institutional autonomy (Amaral et al., 2003; Pechar, 2003),
- new social demands for greater transparency and accountability (Hockfield, 2008; Shupe, 2008; Geuna and Martin, 2003).

“Public accountability” has been a key theme in public management reforms around the globe (Christensen and Lægreid 2011, p. 12) and it appeals also to universities. Accountability has many connotations and definitions. It can be understood as the obligation of public sector entities to the citizens and other stakeholders to account, and be answerable to, democratically chosen supervisory bodies, for their policies, decisions, and actions, particularly in relation to public finances (IIRC, 2016 p. 42). For public institutions accountability is a continues reliability and clarity of settlements (Sułkowski, 2016, p. 11). In higher education there are time-honored traditions relating to performance measurement that nowadays are boosted by the need of external accountability requirements that should be implemented into a system of financial accounting and reporting (Fijałkowska, 2016, p. 97). As Stensaker and Harvey (2011, p. 1) underline “one of the most profound changes in higher education during the last couple of decades is the increasing interest in accountability”. Accountability is about demonstrating that the resources available to institutions yield

presumed education gains (Eaton, 2009, p. 1). The changes and challenges universities face with regard to operations are concerned with mass expansion of higher education (increased accessibility of higher education), internationalization, student access and mobility, decrease in public expenditure, diversification and commercialization of higher education, and the impact of information and communication technologies (Vukasovic, 2008 and Felt 2003). They all have impacted on the delivery of quality education as well as on the notions of autonomy, academic freedom, its changing focus and responsibilities towards society (Vasilescu, et. al., 2010). As Browning (2012, p. 1) underlines: “Accountability goes beyond responsibility. Whereas responsibility is generally delegated by the boss, the organization, or by virtue of position, accountability is having an intrinsic sense of ownership of the task and the willingness to face the consequences that come with success or failure”.

Leville (2005, p. 10) underlines that accountability is a systematic method to assure those inside and outside the higher education system that colleges and universities – and students – are moving towards desired goals, whereas accountability system for higher education are the systematic collections of input, process, and outcome data, their analysis and information dissemination, contributing to internal and external decision making by policy maker, educational leaders, and other stakeholders in the higher education institution. Universities have a wide spectrum of stakeholders that ask for accountability; i.e. governors and legislators, internal governing bodies of universities, deans, professors, researchers, the general public, the community in which the university is located, accrediting bodies, media, students, their parents, alumni, business representatives, sponsors, social and civic organizations. There are growing expectations facing universities that should account for the use of public and private funds. Universities are expected to prove the compliance with a growing array of national regulations and guidelines. Universities need to present evidence that they fulfill their various obligations and responsibilities, that the goals are being accomplished and that money was spent wisely.

The increasing social concern about establishing procedures of accountability and ensuring information transparency in public universities prompted the need to disclose information on their intellectual capital (Corcoles and Ponce, 2013). The current financial systems for research in many countries link the funds received by university with their research performance. By doing that, the funding organizations are forcing higher education (HE) institutions to build indicators and disclose them (OEU, 2006, p. 227).

In recent years, a third mission, over to the traditional teaching and research functions has been added, meaning the purpose of contributing directly to social and economic development (Bratianu, 2009). Universities are considered critical institutional actors in national innovation systems within the knowledge-based economy (OEU, 2006, p. 231). Governments wish to assure that the actions of publicly funded universities are consistent with the social values of efficiency, equity, and academic quality (Dill, 2001, p.22). In many European countries, their governments provided universities with more autonomy concerning their organization structure, management, and budget allocation, however as they fund their activities, they need also evaluate and reward universities’ performance, which demands measurements and reporting mechanisms.

Universities must acquire a model of governance to strengthen institutional autonomy, and in the same time they need to prove greater transparency and accountability toward society and increased control over the results. Moreover, knowledge is the main output and input in these

institutions (Corcoles and Ponce, 2013, p. 114). In this context, reporting on intellectual capital becomes crucial in the universities (Habersham et al., 2013; Leitner, 2002;

3 Intellectual capital of universities

Intellectual capital is defined by the European Commission (2006, p. 4) as a combination of intangible resources and activities that enable the organization to transform material, financial and human resources in a system capable of value creation. IC is forming a human, structural and relational capital. Universities are organizations whose capital is largely intangible, relying mainly on the knowledge that they create, hold and distribute. “If a knowledge-based economy is characterized by the production, transmission and dissemination of knowledge, universities are unique in all these three processes” (Sánchez and Elena, 2006).

Intellectual capital associated to universities refer to more specific aspects of an organization: human capital is the knowledge and experience of the staff, students and graduates, structural capital is knowledge integrated into the structure, processes and culture institutional/ professional and relational capital comprises relationships inside and beyond the university (Fazlagic, 2005). The components of the intellectual capital or universities are presented in the table 1.

Table 1: IC’s components for universities

	Human capital	Organizational / Structural capital	Relational capital
Description	knowledge that the human resources (teachers, researchers, PhD students and administrative staff) would take with them if they left the institution. HC refers to the intangible value that resides in the individual competencies.	the knowledge that stays within the institution at the end of the working day. SC Refers to the resources that are found in the organisation itself.	all resources linked to the external relationships of the institution. RC refers to the intangible resources capable of generating value linked to the university’s internal and external relations.
Examples	expertise, knowledge and experiences of researchers, professors, technical and administrative staff and students’ competencies.	governance principles, organisational routines, procedures, systems, cultures, databases, publications, intellectual property, research projects, research infrastructure, research and education processes and routines, university culture	“customers” relations, “suppliers” relations, all the activities and relations between university and non-academic partners: firms, non-profit organisations, public authorities, local government, and society as a whole

Source: own work based on OEU, 2006, Sanchez and Elena, 2006, Leitner et al, 2014

Within each category we distinguish between financial and non-financial indicators, as well as between resources and activities.

Bratianu (2014, p. 14) however underlines, the evaluation of the intellectual capital should not anymore be done using the human capital, structural capital and relational capital

components, but using the cognitive capital, emotional capital, and spiritual capital components. This new paradigm can reflect much better the university intellectual capital than any other simpler models developed so far. Bratianu (2008) underlines also the importance of integrators in the dynamic structure of the ICU. He indicates that the most powerful integrators for universities are: leadership, management and organizational culture. Each of these integrators acts mostly on the emotional knowledge field, the only field able to stimulate knowledge sharing and knowledge creation (Bratianu 2013, p. 223).

According to Fazlagic (2005 p. 3-4), the intellectual capital of universities should be measured for the following reasons:

1. The transparency of public institutions should be increased. In a knowledge-based society citizens demand constant and comprehensive access to the information when public funds are allocated.
2. The press ranking lists of universities need to be compared with other benchmarking methodologies which aim at 'measuring' rather than 'ranking' educational institutions, leaving the final decision on which university is 'better' to the reader.
3. The strengthening of links between universities and industry cannot be possible without introducing a common language. This 'common ground' would enable academics and business practitioners to develop mutually beneficial relationship
4. The measurement of IC in universities will bring the 'ivory-tower philosophy' of the present researchers closer to the requirements of the public and industry.

The measurement of ICU may be run following frameworks proposed by different institutions (e.g. Danish Agency for Trade and Industry, 2003). Set of indicators that may be used in order to measure the ICU were proposed by e.g. Bueno, Morcillo & Rodríguez, 2002, Leitner 2004, OEU 2006, van Vught & Ziegele 2011 and Leitner et al, 2014. In a consequence of measurement process the ICU reports may be prepared and disclosed. The measurement and reporting of IC at the universities falls into the general idea of Intellectual Capital Management (ICM) that is a set of managerial activities aimed at identifying and valuing the knowledge assets of the organizations, leveraging these assets through knowledge sharing, and creating new knowledge (Easterby-Smith & Lyles, 2003; Holsapple, 2003). IC management can provide an effective methodology to support governance mechanisms (Bornemann and Wiedenhofer 2014) and should not be understood as 'yet another management tool', but it should be at the core of the decision-making process (Secundo et al., 2015) and can be developed especially to improve relational capital along the value chain (Bornemann and Wiedenhofer, 2014).+

All these activities are aimed at the improvement of internal management and increase in external transparency of university. They are also embedded with the idea of the New Public Management (NPM) or "new managerialism" and the post – NPM. Deem (1998, p.) underlines the term "new managerialism" is generally used to refer to the adoption by public sector organizations of organizational forms, technologies, management practices and values more commonly found in the private business sector. NPM is the response to the perceived lack of focus on performance, outcomes, efficiencies and transparency of public institutions and as an answer it proposed the application of managerial approaches and techniques used by business entities in the public organizations (Almqvist and Skoog, 2007). The post-NPM emerged as an answer to NPM critiques and was aimed at building structural capacities of public organizations, which shifted focus from outcomes to inputs, better coordination of efforts with emphasis on networks and cooperation and building 'common values and ethics'

instead of fostering NPM-style competition (Christensen and Læg Reid (2007). As it is underlined in Leitner et al (2014, p. 12) the principles of post-NPM doctrine seem highly compatible with the logic of IC management, as they both emphasize a holistic and multi-dimensional approach to assessment of performance, strengths and weaknesses of university, underline the role of networks and cooperation with other organizations and society at large (instead of treating external actors merely as clients). Furthermore, post-NPM and IC management focus on capacities and assets of organizations rather than solely on outputs in the measurement efforts.

4 IC reporting in universities

The IC report should contain information on the work carried out by the institution in order to develop, maintain and manage its intangible resources and activities (MERITUM, 2002). Its main objective is to help universities to identify and deliver information on strategy, aims, visions, activities and resources, based on (financial and nonfinancial) indicators. IC management and reporting systems should provide information about the specific strengths and value of the IC of an organization and addressed different stakeholders (Leitner at all, 2014, p. 10).

The attempts and trials to disclose the IC of universities are taken by many universities worldwide. A first attempt to provide a homogenous and comprehensive framework for managing and reporting IC in universities was developed by the Observatory of European Universities (OEU). The aim of the Observatory was to develop a common framework for the IC reporting at universities. Fifteen universities and research institutes from eight European countries (Germany, Spain, France, The Netherlands, Hungary, Italy, Portugal and Switzerland) have worked together during two years in order *“to develop a common framework and build a battery of indicators to measure and compare the intangible elements related to research activities. Its main objective was to provide universities and research centers with the necessary tools for the governance of research activities”* (Sanchez et al., 2007, p. 5). As the result, the Strategic matrix was proposed which represents the relations between strategic and transversal issues (Autonomy, Strategic Capabilities, Attractiveness, Differentiation Profile and Territorial Embedding) and five thematic dimensions (Funding, Human Resources, Academic Production, Third Mission and Governance). The analysis of the inter-relations was made first by formulating key questions and then by suggesting precise indicators to answer such questions. As a result, a specific framework for IC reporting for European universities was developed. It was structured in a way to enable the three main sections of IC:

- Section reflecting the vision of the institution (strategic objectives, strategic capabilities and key intangible resources that are the driving forces of any enterprise).
- Summary of intangible resources and activities (intangible resources the institution can mobilize and the different activities undertaken to increase the value of those resources).
- A system of indicators; the 43 indicators proposed were classified following the most common and widespread IC taxonomy, into human, organizational and relational capital.

The main idea of all the works within OEU was the improvement of quality and competitiveness of universities as well as setting out the framework for comparisons. As it is underlined in the OEU Guidelines for the management of research activities „disclosure is the next natural step after management, in order to increase the quality of research systems as well as their transparency and competitiveness as required by the Bologna process” (OEU, 2006, p. 226). The intellectual capital disclosure results in a higher transparency of the institution, increased user satisfaction and improved credibility, image and reputation of the University, while it is the lack of internal systems of identification and measurement of intangible elements the main reason for not disclosing information on intellectual capital (Corcoles and Ponce, 2013).

The proposal of OEU (2006) underlines that it is necessary to treat ICU report as new model to provide homogenized information, presenting IC information in a single document. The starting point for the preparation of ICU report is the defining the strategic objectives of University. Than appropriate indicators should be created. OEU indicates that the ICU report should have three different parts which depict the logical movement from internal strategy (design of vision and goals of the institution) and management to the disclosure of a system of indicators. Besides indicators, it requests also the inclusion of descriptive elements that are crucial to contextualize and better understand the information provided by the indicators.

5. Worldwide application of ICU reporting

In the realm of practice, an increasing number of universities and research centers in Europe have developed IC management and reporting models (Leitner et al, 2014). The majority of approaches and measurements/reporting practices were used on the voluntary bases. One of the most outstanding and longest experiences in preparation of IC reports is the Austrian Research Centers ARC (2005). The ARC model and principles have become the main foundations for IC reporting in Austrian universities. The Austrian case is a remarkable example since it has established a law that includes the compulsory delivery of an Intellectual Capital Report (ICR) (“Wissensbilanz”) by its publically funded universities since 2006. In ARC the focus is around five “knowledge goals”: Knowledge Transfer, Interdisciplinarity, Research Management, Internationality and Spin-offs & Investments. It is worth mentioning that although Austrian public universities were the first in Europe forced by law to implement so called Knowledge Balance Sheets (KBS) and detailed intellectual capital reporting, these organizations are relatively under-researched concerning new reporting practices and their consequences (Habersam et al., 2013).

Beside Austria, Spain has the most active community aiming to establish IC reporting for university sector (Leitner et al. 2014). The Spanish experience concerning IC reporting is to a great extent based on the research performed by the Autonomous University of Madrid (AUM), as a pilot university within the PRIME Network of Excellence and OEU. Following the pioneer approaches, different European universities are beginning to manage their Intellectual capital through different models and disclose ICU reports. The examples embrace Italy, Lithuania, Poland, Czech Republic, Romania, Greece, Latvia, New Zealand, Australia, the UK and Colombia. In the table 2 the main characteristics of qualitative and quantitative empirical research in IC reporting of universities are presented.

Table 2. Main characteristics of qualitative and quantitative empirical research in IC reporting of universities

Study	Country of Study	Scope of research	Methodology	Sample
Ramirez, Tejada & Manzaneque (2016)	Spain	Analyze the relation between IC reporting and transparency	Questionnaire divided into two main categories: analysis of current accounting information model in Spanish universities and importance of IC reporting	Members of the Social Councils of Spanish universities (327 questionnaires were returned, response rate of 28.09%)
Ramirez & Gordillo (2013)	Spain	Provide a model for recognition and measurement of IC	Questionnaire to identify the expectations of stakeholders regarding intangible elements	Members of the Social Councils of Spanish universities (247 questionnaires were returned, response rate of 22.57%)
Kuralova & Margarisova (2016)	Czech Republic	Analyze the extent and quality of IC disclosure in relation to the needs of one group of stakeholders - students	Content analysis using IC disclosure index , questionnaire to evaluate the importance of variables in IC disclosure index	26 annual reports of Czech public universities (content analysis), students of Czech public universities (595 questionnaires were returned)
Siboni, Nardo & Sangiorgi (2013)	Italy	Analyze what Italian public universities consider as IC in their performance plan (since 2009 performance plan with the section devoted to IC has become a mandatory document for universities).	Content analysis of IC in performance plans based on Danish guidelines, which divide information into 3 areas: management challenges, actions and initiatives and indicators	44 performance plans (out of 67 Italian public universities) published in the year 2011
Sangiorgi & Siboni (2017)	Italy	Analyze the amount and nature of voluntary IC disclosure	Content analysis of IC disclosure in voluntary Social Reports, questionnaire to evaluate the opinion on IC managing and reporting	17 Social Reports (content analysis), 95 universities' top managers

Low, Samkin & Li (2015)	New Zealand, Australia, UK	Analyze the quality of IC voluntary disclosure and to indicate potential trend in IC reporting	Content analysis of IC voluntary disclosure	Disclosures from 90 universities (eight New Zealand universities, 38 Australian universities, and 44 UK universities)
Bezhani (2010)	UK	Analyze the amount and nature of voluntary IC disclosure	Questionnaire divided into two main categories: analysis of current accounting information model in Spanish universities and importance of IC reporting	Disclosure from 30 UK universities for 2005 academic year, 18 directors of finance (15% response rate) submitted valid questionnaires
Leitner & Warden (2004)	Austria and Germany	Analyze various aspects after the implementation of a model for IC reporting in two research organizations.	Case study analysis of the implementation and the usage of the model	Two research organizations ARC (Austria) and DLR (Germany), analysis has been conducted after 4 years of model implementation.

Source: own elaboration

6. Conclusion

To the best knowledge of authors, this is the first research that analyzes the success of the top five telecommunication vendors from intellectual capital perspective. It also verifies the capability of VAICTM in predicting firm financial performance. In addition, positive associations of HCE and firm financial performance are partially proved. Finally, significant relationship existing between SCE and financial performance is testified.

Besides theoretical contribution, this study also offers some implications for the firms in the telecommunication industry. Under the hypercompetitive business environment, it is critical for the firms of the telecommunication industry to improve the capabilities of the staff. Training and development programmes, knowledge management programmes, corporate universities are good entry points for individual's growth. On the other hand, international talent recruitment can help the firms to enhance their capabilities. Moreover, satisfying reward and compensation management system should be designed to remain the talents in the firms. Therefore, global vision on the human resource management is imperative in the globalized market.

To improve the profitability, productivity and return on equity, the firms are suggested to transform their HC into SC, especially on the technology innovation, which can offer these telecommunication vendors a huge competitive advantage. Furthermore, it is beneficial to join the intellectual property alliance with the large telecommunication vendors, such as Ericsson, Huawei, which can save the R&D cost and avoid intellectual property infringement.

This research also has its limitations, which can be addressed for future study. The VAIC™ approach was not considered as a valid approach to measure IC (Stähle, Stähle, & Aho, 2016), thus, new methods of IC measurement based on the financial data sheet would be developed to retest our hypotheses. Furthermore, the relationship between HCE and ROE is not significant, it needs to be investigated into details for the reasons. According to the study, SCE is positively related to financial performance. In this study, only one of the indicator of SC: patents are examined. Although it's not easy to quantify all the elements of SC, such as information management systems, management processes, it is still necessary to verify the role of SC from other indicators on facilitating the success of telecommunication equipment vendors in the future.

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References

- Abboud, L., & Silver, S. (2006, 12/04/2006 Dec 04). Alcatel-Lucent Hits the Ground, Prepares to Cut Products and Jobs. *Wall Street Journal*. Retrieved from <http://search.proquest.com/docview/398994560?accountid=16210>
- Amesse, F., Latour, R., Rebolledo, C., & Séguin-Dulude, L. (2004). The telecommunications equipment industry in the 1990s: from alliances to mergers and acquisitions. *Technovation*, 24(11), 885-897. doi:10.1016/S0166-4972(03)00031-2.
- Anonymous (2009). A key differentiator: The corporate university at Alcatel-Lucent. *Development and Learning in Organizations*, 23(6), 28-30.
- Anonymous (2013). Global LTE Infrastructure Market. Retrieved from <http://www.technavio.com/report/global-lte-infrastructure-market-2014-2018>.
- Anonymous (2016). Telecommunications Equipment Manufacturing. Retrieved from http://www.researchandmarkets.com/reports/1052610/telecommunications_equipment_manufacturing#pos-8
- Baladi, P. (1999). Knowledge and Competence Management Ericsson Business Consulting. *Business Strategy Review*, 10(4), 20-28.
- Bontis, N., Dragonetti, N. C., Jacobsen, K., & Roos, G. (1999). The knowledge toolbox: A review of the tools available to measure and manage intangible resources. *European management journal*, 17(4), 391-402.
- Castilla Polo, F. (2007). The recent history of intellectual capital: the most significant topics and contexts in its development. *International Journal of Accounting, Auditing and Performance Evaluation*, 4(4), 360-381.
- Chan, K. (2009a). Impact of Intellectual Capital on Organisational Performance: An Empirical Study of Companies in the Hang Seng Index (Part 1). *Learning Organization*, 16(1), 4-21. doi:10.1108/09696470910927650
- Chan, K. (2009b). Impact of Intellectual Capital on Organisational Performance: An Empirical Study of Companies in the Hang Seng Index (Part 2). *Learning Organization*, 16(1), 22-39. doi:10.1108/09696470910927650
- Chen, M.-C., Cheng, S.-J., & Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. *Journal of intellectual capital*, 6(2), 159-176.

- Cheng, R., & Raice, S. (2011). Huawei, Motorola Strike a Truce in Dueling Lawsuits Over Patents. Retrieved from <http://www.wsj.com/articles/SB10001424052748703551304576260584071937622>
- Chu, S., Chan, K., & Wu, W. (2011). Charting intellectual capital performance of the gateway to China. *Journal of intellectual capital*, 12(2), 249-276.
- Clarke, M., Seng, D., & Whiting, R. H. (2011). Intellectual capital and firm performance in Australia. *Journal of intellectual capital*, 12(4), 505-530.
- DATI, . (1998). *Intellectual capital accounts: new tool for companies*. Copenhagen.
- Edvinsson, L. (1997). Developing intellectual capital at Skandia. *Long range planning*, 30(3), 320-373.
- Edvinsson, L., & Malone, M. S. (1997). *Intellectual capital: Realizing your company's true value by finding its hidden brainpower* (Vol. 225): HarperBusiness New York, NY.
- Ericsson. (2002). Ericsson and Huawei Technologies sign patent license agreement on mobile technology. Retrieved from <https://www.ericsson.com/news/871080>
- Ericsson. (2016). Ericsson and Huawei extend global patent cross license agreement. Retrieved from <https://www.ericsson.com/news/1978769>
- Fan, P. (2006). Catching up through developing innovation capability: evidence from China's telecom-equipment industry. *Technovation*, 26(3), 359-368.
- Firer, S., & Mitchell Williams, S. (2003). Intellectual capital and traditional measures of corporate performance. *Journal of intellectual capital*, 4(3), 348-360.
- Gross, G. (2011). Huawei Sues Motorola for IP Infringement. Retrieved from <http://www.cio.com/article/2411808/legal/huawei-sues-motorola-for-ip-infringement.html>
- Huang, S. Y. (2014). *Intellectual Capital measures: Literature review*. Paper presented at the Management of Engineering & Technology (PICMET), 2014 Portland International Conference on.
- Itami, H., & Roehl, T. W. (1987). *Mobilizing invisible assets*: Cambridge, Mass. : Harvard University Press.
- Kaplan, R. S., & Norton, D. P. (1992). The balanced scorecard - measures that drive performance. *Harvard Business Review*, 70(1), 71-79.
- Komnencic, B., & Pokrajcic, D. (2012). Intellectual capital and corporate performance of MNCs in Serbia. *Journal of intellectual capital*, 13(1), 106-119.
- Lazonick, W., & March, E. (2011). *The Rise and Demise of Lucent Technologies*. Paper presented at the Business History Conference, St. Louis, Missouri.
- Liu, C., & Yuan, Y.-j. (2008). Empirical Study on Effect of Intellectual Capital on Management Performance of Companies. *Journal of Northeastern University (Social Science)*, 1, 009.
- Luo, Y., Cacchione, M., Junkunc, M., & Lu, S. C. (2011). Entrepreneurial pioneer of international venturing: The case of Huawei. *Organizational Dynamics*, 40(1), 67-74.
- Maditinos, D., Chatzoudes, D., Tsairidis, C., & Theriou, G. (2011). The impact of intellectual capital on firms' market value and financial performance. *Journal of intellectual capital*, 12(1), 132-151.
- Marquardt, D. (1970). Generalized Inverses, Ridge Regression, Biased Linear Estimation, and Nonlinear Estimation. *Technometrics*, 12(3), 591-612.
- Mehralian, G., Rajabzadeh, A., Reza Sadeh, M., & Reza Rasekh, H. (2012). Intellectual capital and corporate performance in Iranian pharmaceutical industry. *Journal of intellectual capital*, 13(1), 138-158.
- Milne, R. (2006). Nokia and Siemens create 'a titan', p. 31.
- Nordick, B. (2016). Alcatel-Lucent Merger Failure: A Critical Analysis. Retrieved from <http://research-methodology.net/alcatel-lucent-merger-failure-a-critical-analysis/>

Pang, D. (2015). Analysis of annual report of the top five telecommunication: The fixed ranks. Retrieved from tele.ofweek.com/2015-04/ART-8320510-8440-28948277.html

Petty, R., & Guthrie, J. (2000). Intellectual capital literature review: measurement, reporting and management. *Journal of intellectual capital*, 1(2), 155-176.

Pucar, S. (2012). The influence of intellectual capital on export performance. *Journal of intellectual capital*, 13(2), 248-261.

Pulic, A. (2000). VAIC™—an accounting tool for IC management. *International journal of technology management*, 20(5-8), 702-714.

Ricknäs, M. (2012). Ericsson and ZTE Settle Patent Lawsuits. Retrieved from http://www.pcworld.com/article/248460/ericsson_and_zte_settle_patent_lawsuits.html

Roos, J., Roos, G., Dragonetti, N. C., & Edvinsson, L. (1997). *Intellectual capital : navigating the new business landscape*. Basingstoke, [England: Basingstoke, England : Macmillan Business, 1997.

Stähle, P., Stähle, S., & Aho, S. (2011). Value added intellectual coefficient (VAIC): a critical analysis. *Journal of Intellectual Capital*, 12(4), 531-551

Schechner, S., & Shayndi, R. (2015, Apr 15). Nokia Agrees to Buy Alcatel-Lucent; Deal creates new global networking behemoth. *Wall Street Journal (Online)*. Retrieved from <https://www.wsj.com/articles/nokia-agrees-to-buy-alcatel-lucent-1429078931>.

Shiu, H.-J. (2006). The application of the value added intellectual coefficient to measure corporate performance: evidence from technological firms. *International Journal of Management*, 23(2), 356-365.

Silver, S. (2009, May 12). Nortel Posts Wider Loss. *Wall Street Journal (Online)*. Retrieved from <http://search.proquest.com/docview/399127126?accountid=16210>
http://erlinking.lib.polyu.edu.hk/sfxIcI41?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:journal&genre=unknown&sid=ProQ:ProQ%3Aabiglobal&atitle=Nortel+Posts+Wider+Loss&title=Wall+Street+Journal&issn=00999660&date=2009-05-12&volume=&issue=&spage=B.4&au=Silver%2C+Sara&isbn=&jtitle=Wall+Street+Journal&bttitle=&rft_id=info:erlc/&rft_id=info:doi/

Stewart, T. A. (1991). Brainpower. *Fortune*, 123(11), 44-60.

Sullivan, P. H. (2000). *Value driven intellectual capital: how to convert intangible corporate assets into market value*: John Wiley & Sons, Inc.

Sveiby, K. E. (1989). The invisible balance sheet. *Stockholm: Affarfgarblen*.

Sveiby, K. E. (1997). *The new organizational wealth: Managing & measuring knowledge-based assets*: Berrett-Koehler Publishers.

Teece, D. J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research policy*, 15(6), 285-305.

Vishnu, S., & Kumar Gupta, V. (2014). Intellectual capital and performance of pharmaceutical firms in India. *Journal of intellectual capital*, 15(1), 83-99.

Wilson, R. (2005). Unions seek emergency job talks after sale of Marconi to Ericsson. *Electronics Weekly*(2216), 1.

WIPO, (2016). U.S. Extends Lead in International Patent and Trademark Filings. Retrieved from http://www.wipo.int/pressroom/en/articles/2016/article_0002.html

Zéghal, D., & Maaloul, A. (2010). Analysing value added as an indicator of intellectual capital and its consequences on company performance. *Journal of intellectual capital*, 11(1), 39-60.

Zhang, G. (2013). *Providing global IT solutions from China: the Huawei story*. Reading, United Kingdom: Reading, United Kingdom: Paths International Ltd., 2013.

Intellectual capital disclosure practices – evidence from Poland

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Abstract: The aim of the article is to analyze the current state of IC reporting studies in Poland in the context of existing studies worldwide. Specifically, the paper attempts to answer the question what is the performance of IC disclosure in Poland and if the changes (or lack of changes) in IC reporting in Poland goes in line with world practices. Such analysis is of crucial importance in a sense that trends in IC reporting identified among Polish entities may be further developed in terms of adopted procedures, aims and methods. Final conclusions of the paper are: Polish IC reporting focuses mostly on largest publicly listed entities, most prevalent method is content analysis with different scales for disclosure index, the general level of disclosing is unsatisfactory, however increasing, there are sectors differences in reporting, most information can be found in CSR and Integrated reports, as a result most IC reporting refers to HC and RC. SC reporting is the most neglected component of IC.

Keywords: intellectual capital reporting, intellectual capital disclosure, human capital, integrated reporting, annual report

1 Introduction

Researchers suggest that intellectual capital (IC) reporting shall be studied due to several reasons. One of them is the proper valuation of each entity. Since traditional accounting concentrates mainly on tangible assets, there is a huge gap in valuating assets which are intangible. IC, in most cases, does not appear in companies' balance sheets. Moreover, its reporting is insufficient which leads to the conclusion that market does not possess full information about entities, thus the efficient market hypothesis may no longer be valid. In-depth reporting by the companies about their most important asset (intellectual) may bring more light on their true value. Marr (2003) identified five main reasons why firms measure and report their IC:

1. To help organisations with strategy formulation.
2. To help assess strategy execution.
3. To assist in strategic development, diversification and expansion decisions.
4. As a basis for employee compensation.
5. To communicate with external stakeholders.

The purpose of this paper is to examine the current state of empirical studies on the extent, quality and determinants of IC disclosures by Polish companies on the base of literature review in the context of existing studies worldwide. Hence, the research questions being asked are:

RQ1: What are the major themes identified in the process of IC disclosure by Polish companies?

RQ2: To what extent IC disclosure performance and practices in Poland go in line with contemporary world experience?

The research method adopted for this study are: meta-analysis of existing literature and tools of descriptive statistics. The structure of this paper is the following: Section 1 is introduction, Section 2 describes the assumptions undertaken for the purposes of literature review. Section 3 outlines the results and discussion which is followed by Section 4 pointing to conclusions and recommendations.

2 Methodology

To conduct a comprehensive literature review several assumptions have been taken. First, analyzed studies on IC disclosure in Poland have been taken in account and reviewed only when the entire or majority of studied sample consisted of Polish entities. Polish entity has been defined as the company based in Poland (headquarter or affiliate) no matter of the type of ownership (domestic, foreign or mixed capital). Second, literature review concentrated only on the results of empirical studies. Hence, papers concerning only theoretical deliberations o IC disclosure were not the purpose of the analysis. Third, possible spectrum of the literature review has been narrowed to the following aspects:

- research objective,
- main findings,
- sample size industry and types of studied firms,
- reference to the foreign entities,
- years covered,
- adopted methods utilized data sources,
- level of internationalization (measure by type of the paper and language of publication).

In total there have been reviewed 33 papers. Brief description each of them with the division on main themes (approach employed) has been presented in table 1.

Table 1: Literature review of Polish empirical studies on IC disclosure

Theme	Study	Research objective	Sample size	Industry	Years covered	Type of firm	Methods	Data sources
Book values of IC	Panfil (2010)	Reporting of IA (disclosed, undisclosed and <i>goodwill</i>) in book terms	35	WIG-20, Banks	2006-2009	Publicly-listed	Content analysis	Consolidated financial statements
	Michalczuk (2012)	Reporting of IA (disclosed, undisclosed and <i>goodwill</i>) in accounting terms	224	Various	2009-2010	Publicly-listed	Content analysis	Annual reports
	Bryl (2017)	Reporting of IA (disclosed, undisclosed and <i>goodwill</i>) in accounting terms	27	Various (12) including financial	2010-2014	Publicly-listed	Content analysis	Annual Reports
IC (explicite) disclosure	Wasilewska (2015)	Detailed extent of IC disclosure. Risk factors of IC	52*	Various (including financial)	2012-2013	Publicly-listed	Content analysis	Annual reports, CSR reports, Prospectuses
	Trocka (2017)	Extent of SC disclosure	26	IT	N/A	Publicly-listed	Content analysis	Annual reports, companies' websites
CSR analysis	Ocieczek & Gajdzik (2010)	Extent and quality of HC and RC disclosure as part of CSR analysis	1	Metal	2007	Large, Private	Case study	CSR report, company website
	Michalak (2010)		100	Various (including financial)		Publicly-listed	Content analysis	CSR reports
	Marcinkowska (2010)	Extent and quality of IC disclosure. Time comparison	14	Banks	2004, 2006, 2009	Publicly-listed	Content analysis Disclosure index 0-5	Annual reports, CSR reports

Bryl (2010)	Quality of HC and RC disclosure as part of CSR disclosure	1	Furniture	2009	Private	Questionnaire	Interview
Marcinkowska (2013)	Extent of HC and RC disclosure as part of CSR analysis	2	Banks	2011	Publicly-listed	Case study	Annual reports, CSR reports, companies' websites
Hąbek (2014)	Extent and quality of HC and RC disclosure as part of CSR analysis	32	Various	2011	SME, Large	Content analysis	CSR reports
Michalczuk & Mikulska (2014)	Extent of HC and RC disclosure as part of CSR analysis	4	Various non-financial	2012-2013	Publicly-listed	Content analysis	Integrated reports
Chojnacka (2014)	Extent of HC and RC disclosure as part of CSR analysis	7	Energy	2012	Publicly-listed	Content analysis	Annual reports
Bagieńska (2014)	Extent of HC disclosure	23	Various (RESPECT Index)	2012	Publicly-listed	Content analysis Disclosure index 0-1	Annual Reports, Consolidated Financial Statements, CSR reports
Hąbek & Wolniak (2015)	Extent and quality of RC and HC disclosure as part of CSR analysis	25*	Various non-financial	2012	SME, Large	Content analysis, Disclosure index 0-4	CSR reports
Krasodomska (2015)	Extent and quality of HC and RC disclosure as part of CSR analysis	12	Banks	2005-2011	Publicly-listed	Content analysis Disclosure index 0-3	CSR reports, Management commentaries
Macuda, Matuszak & Różańska (2015)	Disclosure practices as part of CSR reporting	20	Various (including financial)	2013	Publicly-listed, Respect Index	Content analysis	CSR reports, Management commentaries

	Hawrysz (2016)	Extent of HC and RC disclosure as part of CSR analysis	16	Banks	2014-2015	Publicly-listed	Content analysis, Disclosure index 0-1	Companies' websites
	Waniak-Michalak & Michalak (2016)	Extent and quality of HC and RC disclosure as part of CSR analysis Determinants of disclosure	123	Various	2010-2011	Large, NGO's	Content analysis, Regression analysis	CSR reports, companies' websites
	Matuszak & Różańska (2017)	Extent and quality of HC and RC disclosure as part of CSR analysis	150	Various	2015	Publicly-listed	Content analysis, Disclosure index 0-4	Annual reports, CSR reports, companies' websites.
	Hąbek, Sujová & Čierna (2018)	CSR reporting patterns	34*	Various non-financial	2015	SME, Large	Content analysis	CSR reports
Integrated reporting analysis	Krasodomska (2013)	Extent of IC disclosure as part of IR analysis	3	Pharmaceutical, oil&gas	2010, 2011	Publicly-listed	Content analysis	Integrated reports
	Tatarska (2013)	Extent of HC disclosure	1	Oil&Gas	2012	Publicly-listed	Content analysis	Integrated report
	Szczepankiewicz (2014)	Extent and quality of IC disclosure as part of Integrated reporting	6	Various non-financial	2012	Publicly-listed	Content analysis	CSR reports
	Bek-Gaik & Rymkiewicz (2016)	Extent of HC and RC disclosure as part of integrated reporting	60	Various (including financial)	2013-2014	Publicly-listed	Content analysis	Annual reports, CSR reports, Integrated reports
ESG reporting	Jędrzejka (2014)	Extent of IC disclosure as part of ESG reporting analysis. Impact of disclosure	862	Various	2012-2013	Publicly-listed (main and alternative market)	Content analysis, Disclosure index 0-3	Annual reports, CSR reports, companies' websites

Determinants of disclosure	Dumitru, Dyduch, Guşe & Krasodomska (2017)	Extent and quality of HC disclosure and its determinants	20*	Various non-financial	2014	Publicly-listed	Content analysis, Disclosure index 0-3	Annual Reports, Integrated reports
	Dyduch & Krasodomska (2017)	Determinants of HC and RC disclosure as part of CSR disclosure	60	Various non-financial	2014	Publicly-listed	Content analysis, Disclosure index 0-3 Regression analysis	Annual Reports, Integrated reports
	Bryl & Truskolaski (2017)	Extent and quality of HC disclosure and its determinants	30*	Various (including financial)	2015	Publicly-listed	Content analysis Disclosure index 1-5	Annual Reports
Miscellaneous	Dobija (2003)	Creating a better method to value IC	1	Auditing	2002	Private, medium	Case study	
	Karmańska & Bareja (2015)	Test of the KL-ARK model to measure the economic quality of intellectual capital	30	Various (including financial)	2012-2013	Publicly-listed	Content analysis	Annual Reports
	Sienkiewicz & Trojanowska (2015)	Extent and quality of HC data gathering for internal purposes	600	Various (17)	2013	SME and large	Questionnaire, CATI	Interview
	Żarnik-Żuławska (2016)	Assessment of the demand for information about the IC	50	Various	2015-2016	Publicly-listed	Questionnaire	Interview

Note: *studies with comparison with the foreign entities

Source: Own work

4 Results and Discussion

4.1 Main findings

Studies on IC reporting can be in general divided into two groups. First one refers strictly to the traditional accounting where IC is reported (identified, classified and valued using accounting techniques) on the balance sheets in the form of intangible assets. These can be e.g.: trademarks, software, licenses, patents. Second approach is based on holistic measurement and more descriptive narration when IC is disclosed without strictly providing its value, however several indices are utilized to present IC presence in the firm. This approach derives from the MV/BV ratio, which according to Dumay (2012) is one of the two grand foundations of intellectual capital disclosure theory. Second basis for intellectual capital disclosure theory is greater profitability because of lower cost of capital.

Studies of IC understood as book values and types of intangible assets reported on the balance sheets in Polish firms were conducted by Bryl (2017), Michalczyk (2012) and Panfil (2010). Panfil's (2010) analysis covered 2006-2009 and concerned on the structure of value of on the sample consisting of banks. Analysis revealed that book values of intangibles fell from 22.5% in 2006 to 10,2% in 2009 what was only a fraction of Market Value Added (MV-BV). In addition, studied sample consisting of banks in comparison to WIG-20 entities recorded lower share of intangibles in total assets in all analyzed years. This suggests that intangible assets, although often stressed as having huge importance in contemporary firms, in fact are not sufficiently reported in the balance sheets. Moreover, among the intangibles the greatest share was attributed to goodwill. Similar study, however on the greater sample (224) of publicly-listed entities from various industries was conducted by Michalczyk (2012) who found that during 2009-2010 the importance of intangibles has increased (measured by the share in total assets) with the greatest share in the case of the following industries: insurance, services (hotels, restaurants, real estate), media, retail and IT, whereas the lowest in chemicals and wood industry. These findings were also observed by Bryl (2017) in the recent study on 27 companies from WIG-30 index on the reporting practices of intangibles book values and their types. The significance differed among the industries with the highest shares in total assets reported in the case of: media, software and telecommunication industry, whereas the lowest ratios were observed in banks, oil and gas entities. Further analysis showed that much of the IC is not reported on the balance sheets in the form of intangible assets (mean share during 2010-2014 amounted to 14,5%) with the greatest values attributed to following types: goodwill, royalties, patents, trademarks and cost of research which shall be perceived as SC items. In addition in almost all studied years intangible assets grew faster than tangible assets.

Much greater abundance of IC studies is observed concerning the second approach. One of the fundamental questions arising is where (what kind of documents?) do companies report their IC? Marcinkowska (2010) states that single IC reports are very rare and IC disclosure usually takes a form of narrative description of the IC forms. In the Authors' study on 14 publicly-listed banks there was not any single bank issuing separate IC report. Similarly Wasilewska (2015), who thoroughly analyzed 27 publicly-listed entities from various industries in terms of their IC disclosure with the clear division of IC into RC, HC and SC, observed that none of the studied firms published a separate report on IC. Studied annual

reports and prospectuses contained limited information on IC and the notion of IC appeared only in the documents of one entity. Most information on IC (however not directly named) were included in the Management commentaries. IC elements (other than intangibles reported on the balance sheets) were described mostly in descriptive form. Similarly the analysis of the Polish 26 IT firms (WIG-Informatyka) conducted by Trocka (2017) revealed that none of the studied firms prepared a separate report on IC or Integrated report. Some IC information was delivered via corporate websites, however its extent and quality differed significantly among studied firms. These findings cover with the analysis of Dumay (2016) who states that: *With a solid start in the late 1990s and early 2000s IC reporting was subsequently supplanted by CSR reporting, and frameworks such as the United Nations Global Compact (2009) and the Global Reporting Initiative (GRI) (2013) soon overtook any hope that IC reporting would become mainstream reporting practice.* As a result studies on IC disclosure have to be undertaken with the use of other, newer, more available sources. In this sense the attention of Polish authors (consciously or unconsciously seeking IC) has been shifted to other publicly available documents issued by enterprises. Concerning annual reports Chojnacka (2014) analyzed the annual reports of seven publicly-listed entities from energy sector and as one of greatest shortcomings of the studied reports found file format of certain reports that prevented from effective search for information what limits the usability of these channel of communication. Author concludes providing recommendation for the future which are: standardization of the report and obligatory set of information to report in the environmental and social field. Macuda, Matuszak and Róžańska (2015) analyzed CSR disclosure practices in terms of published documents. Authors observed that almost half (48%) of 20 studied publicly-listed entities issued a separate CSR report, whereas 74% report on CSR on their websites and 26% publish information about CSR in the Management commentary. Newer study concerning the type of communication channel on CSR (annual report, CSR report, corporate website) by Matuszak and Róžańska (2017) on the sample of 150 publicly-listed firms revealed that 76% of the analyzed companies used at least one channel of reporting. This means that almost a quarter of companies (36 companies; 24.0%) do not communicate their CSR practices at all. Moreover, 58% of the entities disclose CSR information in annual reports, on the other hand this is the only disclosure channel for 16,7% of the companies. Moreover, 57.8% of firms present information about CSR on their websites, which is the only CSR disclosure medium for 16.0% of the entities. This suggests that annual reports and the corporate websites are more popular communication channels for the Polish publicly-listed enterprises compared to CSR reports. However, study by Hąbek, Sujová and Čierna (2018) on the sample of 34 large and SME companies showed that in Poland, separate CSR reports are the dominated type (82%) of reports. Reporting practices were the most prevalent in the case of large enterprises, in particular, those that are subsidiaries of large multinationals. Average length of a separate CSR report was 64 pages. Moreover, all reports were prepared in accordance with the GRI guidelines. 65% of them were written in Polish language tongue, 35% were in two languages (Polish/English) and none of them was prepared only in English. Most reports were prepared in PDF format and downloadable from a website of the entity. In addition, almost 40% of reports from Poland were in the form of an interactive on-line report what enables the reader to choose interesting content and creating individual reports tailored to his/her needs. Hąbek and Wolniak (2015) analyzed the CSR reports of 25 SME and Large

entities from various industries and stated that only 16% of the CSR reports were audited by external organization. Authors observed also, that studied reports very rarely containing information (name and contact data) on the person responsible for the development of the report. Although the relevance of the information provided in the evaluated reports was higher than its credibility, the quality level of the studied reports is generally low, and there is space for improvement. In terms of utilizing integrated report as source of data on IC Michalczuk and Mikulska (2014) studied integrated reports of four publicly-listed entities in terms of: aim, rules and key elements. Authors found that only one of them was verified and audited by external body. Moreover, studied reports differ significantly what creates obstacles in domestic and international comparisons, what would increase the sense and value of integrated reporting. However, as state Bek-Gaik and Rymkiewicz (2016) who analyzed 60 Polish publicly-listed entities reporting practices found the firms mostly report with the help of Financial statement (100% of studied firms) and Management report (98,3%). Annual report was issued by 48,3%. Single-alone integrated report was issued by only 5%. Companies did not perform high interest in publishing Environmental and Sustainability Reports (less than 5% of the studied entities). Moreover, authors stated that integrated reporting in Poland is in the early stages of development (study referred to the 2014-2015 years) and diffusion of its ideas is slowly moving into the business. The quantity of integrated reports issued is not high, however rising trend has been observed (67% in one year). Reports are mainly created by the companies which are leaders in their industries. On the other hand, Authors stated that some entities do not release full integrated reports, but introduce its elements into the traditional annual reports. Moreover, the structure of integrated reports is to great extent similar to the guidelines proposed by IIRC, however the quality of disclosure may generate concerns, as some elements are neglected (especially business model). Tatarska (2013) on the example of one integrated report of one publicly-listed entity concluded that one of the advantages of integrated reporting is the possibility to make a collective insight into the firm and analyze its activity in various fields. Additionally, integrated reporting enables to compare indices concerning operations and hence optimize the investment decisions. However, among the disadvantages of integrated reporting Author found its relatively high cost of issuing, a lot of effort and necessity to involve external auditors. Szczepankiewicz (2013) conclusion of the studies on six publicly-listed entities showed that integrated reports should present factors used to achieve in the long-term success in terms of sustainability and CSR. Important role play the issue of comparability. Furthermore, integrated reports should logical, coherent and complete. Moreover they should provide a balance between being too long and too short, too complicated and to superficial.

Among the other forms of studying IC reporting there should be mentioned case study which may utilized not only officially publicly available corporate documents but also questionnaire. Chiuichi (2013) stresses that the findings from case study research on IC disclosure improve the understanding how firms introduce IC accounting processes that internally mobilise IC. Bryl (2010) analyzed the HC and RC disclosure among the CSR activities on the example of foreign-owned Polish based entity from the furniture industry with the help of questionnaire and case study as final outcome of the study. His findings, based on the narrative description, show that questionnaire is a useful source of collecting data on IC, since the company was

eager to disclose much in terms of HC (employment, trainings, employee participation) and RC (mostly in terms of society engagement). Similarly thinks Ousama et al. (2011) who argues that surveys have many benefits, however frequent problem is related with the unsatisfactory level of response rate. Consequently surveys are rarely found in international research on IC disclosure. Moreover, Marcinkowska (2013) using the case study method studied thoroughly reporting of two banks in terms of HC and RC disclosure as part of CSR analysis. Author explained how HC and RC is created from the view of different stakeholders. Quantitative (indices) and qualitative methods have been utilized. As a result of deep analysis and broad spectrum of secondary data sources Author presented logical and well-designed picture of two banks. What is important, there has been stressed that although banks present themselves as responsible entities the market will determine the truth of the statements.

Nevertheless one of the final goals of studying IC disclosure in enterprises is to gain information on the extent and quality of reporting. Early studies on IC disclosure were conducted by e.g. Marcinkowska (2010), who claimed that extent and quality of IC disclosure is unsatisfactory (mean value of the points amounted to only 25% of the total points possible to achieve). The best performing bank scored only 59% of the total points. In terms of the IC components best disclosed IC form were RC and HC reporting (28% of the total points). SC reporting scored 25%. However, it should be noted that the studied sample differed significantly (standard deviation amounted to 70%). In fact there were 2 banks that scored only 4% and 5% of the total points possible. Hąbek (2014) evaluated the quality of CSR reporting including the items referring to HC and RC among 32 SME and large entities. Author stated that the average score for all the reports evaluated in the study was 34% of the maximum possible points. Almost 60% of the reports have been prepared in line with GRI Guidelines, while 19% of them were verified by an independent entity. Moreover, Author argued that many studied reports do not contain essential data on previous years' targets achievement and next year's targets commitment in the terms of sustainability performance. In fact, reports take the form of are extensive publications resembling stories and lacking or having very limited metrics/indicators. Moreover, most of the reports were published by large entities, however, as Author states, majority of enterprises in the Polish economy are small and medium-sized. Wasilewska (2015) on the sample of 27 publicly-listed firms observed that quantitative data on IC were rare. Most often reported element of IC was RC followed by SC. Large entities (especially the one forming WIG30) performed better in the case of IC reporting and firms from services sector reported better industrial companies. Bryl and Truskolaski (2017) analyzed the extent, quality and determinants of HC reporting on the sample of WIG-30 publicly-listed entities from various industries. Authors found out that in terms of frequency the most frequently reported HC component were: employment structure (100%), employee benefits (96.7%), development programme (93.3%) and stock option plan (93.3%). However concerning the quality of reporting (measure by the disclosure index) it was revealed that reporting of the above mentioned items is unsatisfactory. Greatest values were found in the case of stock option plan and employee benefits, however their scores amounted to 61.4% and 51.4% of the total amounts of points respectively. Mean quality of the employment structure disclosure amounted to 34.8% of total points. In general, the mean score for HC reporting should be perceived as low (43% of the total amount of points to receive). One of

the study on the 23 entities from the RESPECT Index¹ was conducted by Bagieńska (2014) who observed that most often reported information on HC were data on employment costs. There was reported unsatisfactory level of HC disclosure in terms of: trainings and employment structure, stock option program and motivational systems. Wasilewska (2015) stated that in terms of HC reporting the most often disclosed information referred to: competences of management and general staff, trainings and motivational programs. In terms of RC studied companies disclosed mostly: brand knowledge, wide offer, substantial market share, diversified distribution channels, long-term relations with customers and marketing activity. Consequently, SC reporting encompassed: trademarks, clearly defined strategy, licenses, patents and R&D expenditures. Tatarska (2013) analyzed the extent of HC reporting as part of the integrated reporting practices on the example of one firm from the oil&gas industry. Author found that enterprise reports on HC by delivering information on: employment, relations between employees and management, occupational safety and health, trainings, variety and equal opportunities. A study by Hawrysz (2016) on 16 publicly listed banks revealed that organizations showed the greatest tendency to disclose information relating to diversity and equal opportunity (44%), training and education (38%), compliance (31%) and employment (27). However, worst disclosed information related to supplier assessment for labor practices, forced or compulsory labor, the security practices, the indigenous rights, the assessment (6%) and supplier assessment for impacts on society (8%). Chojnacka (2014) noticed that basic disclosure on number of employees was reported by all studied firms and usually appeared at the beginning of the report, however data on structure of employment was disclosed by 4 firms. Only one company reported studies on job satisfaction. Szczepankiewicz (2013) found that integrated reports present following data on HC and RC: employment, staff relations inside organization, occupational health and safety, trainings, variety and opportunities equality, fair salaries, trade unions, free market rules, customer privacy and marketing communication. Dumitru, Dyduch, Guşe & Krasodomska (2017) on the sample of 20 publicly-listed entities from different non-financial industries observed that more than 50% of Polish companies did not disclose any information on the social and employee-related matters with the only exception for reporting on trade union rights, which was showed by the entities in which trade union organizations have a strong position (e.g. the mining, energetics and basic materials sector). Authors analysis was based on the corporate reporting practices thus it did not encompass only HC reporting but also broader group of factors referring to strategy, business models and environmental impact. The results in the field of HC showed that no disclosure was recorded in terms of fundamental labour conventions, dialogue with communities and gender equality in all (100%), 75% and 65% of the analyzed firms respectively. Hąbek and Wolniak (2015) assessed the quality of HC and RC reporting as part of CSR disclosure analysis. General scores of HC and RC were relatively similar, however best scored IC element was HC (according to the study framework: “workplace”), however the overall score was 1,88 in 0-5 scale, what accounts for only 37,6% of total possible points, followed by RC (understood as: “Marketplace” and “Community”) with the score 1,62 (32,4% of total possible points). In turn, Trocka (2017) noticed that best reported form of IC was SC among which information of products/services and innovations

¹ Warsaw Stock Exchange launched RESPECT Index that encompassed socially responsible firms.

were the most prevalent. Worst performed element of SC was disclosure on management methods. Matuszak & Różanska (2017) stated that community involvement (RC) and labour practice (HC) were predominantly reported. Least disclosed IC components were intellectual rights and anti-corruption criteria. Early international studies (Guthrie & Petty, 2000; Brennan 2001; Bontis, 2003) provide information that there was a small number of companies interested in the identification and measurement of IC. Similarly, Xiao (2008), Yi and Davey (2010), Singh and Kansal (2011) stated that disclosure practices of IC are rare. Moreover, the lack of commonly accepted research scheme seems to be an obstacle.

Time analysis has been adopted in three studies: Marcinkowska (2010), Krasodomska (2015) and Jędrzejka (2014). Marcinkowska's (2010) study revealed that during 2004-2009 most of the banks not only did not improve their IC disclosure performance but decreased the extent and quality of IC reporting in all IC fields. However, there were some exceptions of the banks that improved their quality of IC reporting significantly. Jędrzejka (2014) studied the extent and quality of disclosure by publicly-listed entities from main (WSE) and alternative (NewConnect) Polish stock market in the context of ESG (environmental, social, governmental) on the sample of total 862 entities. In this sense, Author studied the IC, however under different nomenclature. He found that on average NewConnect firms reported worse by 60% than WSE companies. As in the case of WSE firms there was no significant improvement observed during 2012-2013, however NewConnect entities recorded a 7% increase in the extent and quality of disclosure. However, Krasodomska (2015) on the sample of 11 publicly-listed banks found that their quality of reporting with the help of disclosure index during the 7-years period has significantly improved (by 105%). Moreover, Author the banks used various terms to refer to CSR (15 different terms were identified) rarely defining the concept itself. However, the term CSR or related terms were used in their management commentaries over all or nearly all the years analyzed.

In the case of disclosure determinants Wasilewska (2015) identified sector as an important factor determining IC disclosure performance. Dumitru, Dyduch, Guşe & Krasodomska (2017) found that reporters' experience, state ownership, as well as the presence and use of voluntary reporting standards, guidance and regulations (as the most important institutional factor in reporting) have a positive influence on the quality of reports of studied of Polish firms. Dyduch and Krasodomska (2017) analyzed factors determining the quality of HC disclosure (as part of CSR reporting) among 60 publicly-listed non-financial entities from various industries such as: company size, profitability, financial leverage, industry environmental sensitivity, board size, women on the board, internationalization, and reputation. It was found out that turnover and duration of the stock exchange listing were the only factors influencing social disclosure level. Higher levels of social disclosure were observed in companies with higher turnover and with shorter duration of the stock exchange listing. Bryl and Truskolaski (2017) stated that among the factors influencing intellectual capital disclosure the firm size (understood as revenue and employment) and industry were significantly important, although the relations were dependable upon the industry (the strongest positive correlation was observed in the services industry). Chojnacka (2014) on the group of seven firms from energy sector found that length of reports depends on the size of the company. Information regarding employment differed according to the level of data

complexity. Jędrzejka (2014) observed a positive relation between annual return on investment and ESG (environmental, social, governmental) disclosure for WSE firms, however for NewConnect entities such correlation was not proved. Based on the experience of foreign Authors studying the determinants of IC disclosure there is hard to derive unambiguous conclusions. Oliveira et al. (2006) state that company size, ownership concentration, type of auditor or industry influence the IC disclosure. However, Bozzolan et al. (2003) found that size and industry do not impact the IC reporting performance.

Marcinkowska (2010) wondered what the reason behind low quality of IC disclosure is. First, she identified low management awareness of the IC importance, and second, lack of public usefulness of IC reporting. Author conducted correlation analysis, which showed that there is no relation between the quality of IC disclosure and IC value (measured by the MV/BV ratio). Karmańska and Bareja (2015) dealt with the theoretical and empirical concept of measuring the economic quality of intellectual resources in enterprises by introducing the KL-ARK model. KL-ARK model evaluates intellectual capital economic quality on the basis of financial categories and is intended to meet the idea of integrated reporting. Empirical evidence on the sample of WIG-30 firms showed that studied firms perform various economic quality of intellectual resources. Enterprises from two sectors: retail and telecommunication have positive indices of economic quality of intellectual resources what suggests (according to the model) that actions undertaken to recruit, retain and develop employees bring benefits what means value added creation and stock prices increase. In contrast, two other sectors (media and insurance) have negative indices. The reason behind was poor competency-based management. Study by Waniak-Michalak and Michalak (2016) concentrates on voluntary disclosure made by NGOs and corporations on their collaboration and its determinants. In this sense research referred to the reporting of RC between the entities of different legal form. Study showed that corporations and NGOs in Poland do not provide much information about their cooperation what may (as Authors suggest) derive from lack of mandatory disclosure and low level of corporations legitimacy in Poland (as a result cooperation with charities may be perceived by public opinion different from what firm pursued). Authors even attempted to draw a conclusion that corporations and NGOs tried to keep their collaborations secret because of being afraid of disclosing too much information what may mean that information on such cooperation may have delegitimizing effect for both sides. Among the factors influencing the collaboration extent size or being a “sinful” company were not significant. Trocka (2017) summarizes her studies by stating that level of IC disclosure is low because of the fact that IT companies are afraid to reveal information of their valuable assets because they fear that competitors may use that information. Similarly conclude Schaper et al (2017) based on the study of Danish firms.

These findings do not provide optimistic forecasts for IC reporting. However, as suggests Bagieńska (2014) more detailed reporting of HC is required so that investors will be able to better interpret the firm strategy and its growth factors. What is interesting, although corporation may restrain from publishing IC data, however the demand for IC data for internal purposes is not diminishing and is of great interest by enterprises. Sienkiewicz and Trojanowska (2015) on the sample of 600 SME and large entities from various industries found out that majority of the companies (55%) measures HC. 81% of these firms monitors their HC

at least once a year. Main reasons behind were respectively: costs limitation, better staff decisions and control if the HC investment bring benefits. Most often data collected on HC were information concerning: number of employees and types of employment, staff turnover and length of employment. However, on average these data referred to not more than 80% of firms collecting any data on HC. Moreover, in most studied firms (about 75%) there are no research on job satisfaction and/or organizational involvement, organizational culture, interpersonal relations, knowledge sharing. Gathered indices mostly refer to the remuneration costs, work absences and trainings. There is a lack of more complex indices such as: HC investment return, economic value added of HC or employee attitudes. Authors identified also main barriers in collecting data on HC, these are: lack of the need for HC identification and measurement and high costs of this procedure, as well as lack of qualified people to collect such data. Żarnik-Żuławska (2016) analyzed the demand and corporate practices among 50 publicly listed entities and found out that 78% companies indicated that the demand for information regarding intellectual capital and its management will increase in the next three years. Moreover based on the studies Author stated that 76% of companies monitor data on absenteeism and collect data on the performance of employees. 74% of companies collect data on the skills and/or knowledge. 70% of the entities monitor the state and structure of employment and staff turnover. 68% of the studied firms gather information concerning labor cost.

4.3 Reporting sources

Most of the IC disclosure in Poland is being conducted with the help of CSR and Integrated reports. Annual reports were important source of data on IC, however not the only one. As Krippendorf (2013) argues researcher should be aware of the limitations of annual reports. Rising perception of other forms of IC reporting can be explained twofold. First, Integrated reports are gaining popularity among the enterprises disclosure practices what for sure should be perceived as positive trend. It is also deeply understandable to search for data in integrated reports, as Abeysekera (2013), Melloni (2015), Veltri and Silvestri (2015) and Dumay (2016) suggest six capitals of the integrated reporting framework in fact includes three types of IC (structural, relational and human). Second, as argues Dumay (2016) IC reporting with the help of special IC reports is nowadays practically absent in this sense that companies do not publish documents dedicated to IC only. The reason for that is emerge of other (probably more attractive) reporting frameworks, such as Global Reporting Initiative and International Integrated Reporting.

4.4 Studied sample

Polish studies show a tendency to concentrate on publicly-listed entities. Overwhelming majority of the studies referred to the largest stock exchange corporations that belong to the two main Warsaw Stock Exchange Indices which are WIG-20 and WIG-30. These companies represents only a fraction of Polish economy and can not be perceived as the representatives of the current state of IC disclosure in Poland. The studies of SME and large, non-listed companies in Polish empirical IC reporting studies is extremely rare. Cuzzo, Dumay, Palmaccio and Lombardi (2017) found that publicly-listed companies are prevailing in the

global IC disclosure studies (62%), while only 3% of the papers investigate private SME. Not many research have been also conducted on the sample of NGO's.

4.5 Internationalization

The internationalization of the studies should be perceived twofold, and thus be able to answer two questions. First (primary internationalization), what was the language and publishing place of the paper? Second (secondary internationalization), was the same study conducted on foreign entities and the results compared with Polish peers? Consequently, there have been 33 papers examined concerning the empirical studies on IC disclosure. 20 of them have been prepared in Polish (60,6%), while 13 were in English (39,4%). Figure 1 presents the breakdown of the papers in relation to type of publication.

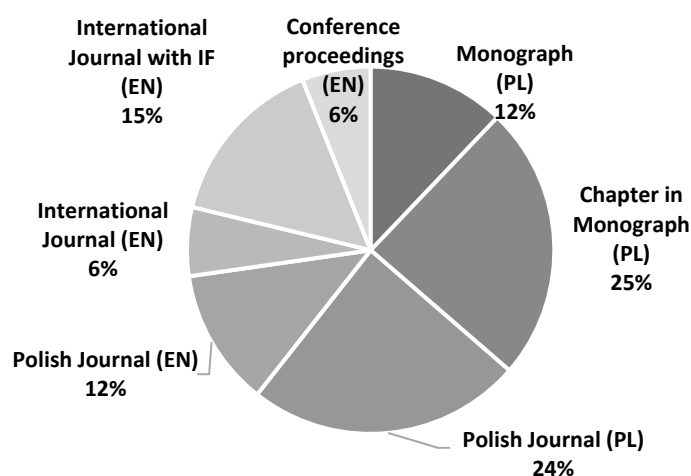


Figure 1 Papers according to the publication type

Note: In brackets there has been presented the language of the paper

Source: Own work

Although the majority of the papers were in Polish, 38,4% of the English papers were presented in International Journal with Impact Factor (mean IF for the four papers equaled 1,00025). Moreover, four studies were conducted with the aim of comparative analysis with the peer firms from one or more countries (Bryl & Truskolaki, 2017; Dumitru, Dyduch, Gușe & Krasodomska, 2017; Hąbek & Wolniak, 2015; Hąbek, 2018). As a result the level of primary and secondary internationalization of Polish studies should be evaluated as moderate with a strong recommendation to improve in terms of English version papers.

4.6 Utilized method

The prevailing method used in the studies on IC disclosure was content analysis. There is a finite number of internationally recognized frameworks for the methodology of content analysis. These can be classified with the rising quantity of levels, e.g. Abeysekera and Guthrie (2005) adopted a simple, two point (zero-one) scale (0 representing nondisclosure while 1 disclosure) whereas Whiting and Miller (2008) proposed three-point scale (0 for nondisclosure, 1 for qualitative disclosure and 2 for quantitative disclosure). There can be even found six-point scales (from 0 to 5) which have been adopted for the purposes of the studies by Shareef and Davey (2006), Schneider and Samkin (2008) and Yi and Davey (2010).

Most of the Polish studies were individually adopted methods in terms of the utilized scale in the disclosure index which are in line with the previous international practices. However the most predominant were four and five-point scales. What is interesting, much of the studies in Poland utilized content analysis as research method of the IC disclosure, however without adopting any disclosure index what in fact leads to the narrative description of the IC disclosure practices what creates obstacles with measurement and comparability of the results. Relatively less frequently adopted method was case study (Dobija, 2003; Bryl, 2010; Marcinkowska, 2013). Although the data load of the case study depends on its preparation, however its final version potentially may provide a lot of useful information and thus better picture of the company IC.

5 Conclusions and recommendations

On the basis of the above conducted review of Polish empirical studies there can be certain conclusions drawn and recommendations for the future research in the area of IC disclosure.

First, the extent and quality of IC disclosure were the most prevalent aim of the Polish empirical studies. Surprisingly, it is rarely directly articulated as IC. Mostly, studies seek for CSR or sustainable activities reporting. General level of IC disclosure is unsatisfactory, however positive trend in better performance is observed. Reporting of IC differs among industries. Second, as IC disclosure among WIG-20 and WIG-30 is relatively advanced, studies should concentrate more on other entities, not necessarily noted on the stock exchange. Studies conducted so far mostly concentrated on (too) small samples. Although, this task sounds understandable, in fact there may serious obstacles emerged, such as simply lack of publicly available data. As a result, other than well-known content analysis should be employed (e.g. questionnaire). Moreover, there should be definitely more studies devoted to the time analysis of the IC disclosure changes. There has not been any longitudinal study identified. However, according to Campbell and Rahman (2010) there is a huge gap and potential for development of this kind of studies worldwide. In addition, the answer what drives the enterprises to disclose better is still ambiguous, as well as what are tangible and intangible benefits from reporting. Annual reports, Management commentaries, CSR and Integrated reports (traditional accounting documents) provide in the era of *new economy* simply not enough information. Adapting social media (with all their advantages and disadvantages) into the IC disclosure studies would improve the information set of studied companies. Finally, publishing “strategy” of Polish studies should be internationally-oriented, as majority of research is published in native language, what does not enable diffusion abroad of the results.

References

- Abeysekera, I., & Guthrie, J. (2005). An empirical investigation of annual reporting trends of intellectual capital in Sri Lanka, *Critical Perspectives on Accounting*, 16(3), 151-163.
- Whiting, R. H., & Miller, J. C. (2008). Voluntary disclosure of intellectual capital in New Zealand annual reports and the ‘hidden value’, *Journal of Intellectual Resource Costing & Accounting*, 12(1), 26-50.

- Shareef, F., & Davey, H. (2006). Accounting for intellectual capital: evidence from listed English football clubs, *Journal of Applied Accounting Research*, 7(3), 78-116.
- Schneider, A., & Samkin, G. (2008). Intellectual capital reporting by the New Zealand local government sector, *Journal of Intellectual Capital*, 9(3), 456-486.
- Yi, A., & Davey, H. (2010). Intellectual capital disclosure in Chinese (mainland) companies, *Journal of Intellectual Capital*, 11(3), 326-34.
- Bryl, Ł. (2010). Społeczna odpowiedzialność biznesu na przykładzie firmy Schattdecor Polska w: Matejun, M & Szczepańczyk, M. (ed.), *Aktualne problemy zarządzania małymi i średnimi przedsiębiorstwami*, Wydawnictwo Politechniki Łódzkiej, Łódź, 455-46.
- Bryl, Ł., & Truskołaski, S. (2017). Intellectual Capital Reporting and Its Determinants by Polish and German Publicly Listed Companies, *Entrepreneurial Business and Economics Review*, 5 (2), 195-210.
- Bryl, Ł. (2017). Intangible assets disclosure by Polish enterprises, *Finanse*, 1(10), 331-354.
- Dumitru M., Dyduch J., Gușe R., & Krasodomska J., (2017). Corporate Reporting Practices in Poland and Romania – An Ex-ante Study to the New Non-financial Reporting European Directive, *Accounting in Europe*, 14:3, 279-304, DOI:10.1080/17449480.2017.1378427
- Matuszak, Ł., & Różańska, E. (2017). CSR disclosure in Polish-listed companies in the light of directive 2014/95/EU requirements: Empirical evidence, *Sustainability*, 9(12), 1-18.
- Matuszak, Ł., Różańska, E., & Macuda, M. (2015). Ujawnienia o CSR na przykładzie spółek notowanych na GPW w Warszawie w: Marzena Remlein (red.), *Rachunkowość Warta Poznania - teoria, praktyka, polityka rachunkowości*, Uniwersytet Ekonomiczny w Poznaniu, Katedra Rachunkowości, Poznań, 145-155.
- Marcinkowska, M. (2013). *Kapitał relacyjny banku. Ocena banku w kontekście relacji z interesariuszami*, Łódź : Wydawnictwo Uniwersytetu Łódzkiego.
- Szczepankiewicz, E. (2014). Ewolucja sprawozdawczości przedsiębiorstw - problemy zapewnienia porównywalności zintegrowanych raportów z zakresu zrównoważonego rozwoju i CSR, *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Finanse, Rynki Finansowe, Ubezpieczenia*, 832(71).
- Michalczyk G., & Mikulska, T. (2014). Sprawozdanie zintegrowane jako produkt finalny rachunkowości społecznej, *Zeszyty Naukowe Uniwersytetu Szczecińskiego. Finanse, Rynki Finansowe, Ubezpieczenia*, 827(69).
- Chojnacka, E. (2014). Rachunkowość na rzecz zrównoważonego rozwoju Gospodarka – etyka – środowisko. *Prace naukowe Uniwersytetu Ekonomicznego we Wrocławiu. Research papers of Wrocław University of Economics* nr 329.
- Hąbek P., Sujová E., & Čierna, H. (2018). Comparative analysis of CSR reporting practices in Poland and Slovakia, *Scientific Papers Of Silesian University Of Technology 2018, Series: Organization And Management* Vol. 116.
- Hąbek, P., & Wolniak, R. (2015). Assessing the quality of corporate social responsibility reports: the case of reporting practices in selected European Union member states, *Quality and Quantity*, 50(1).
- Waniak-Michalak, H., & Michalak, J. (2016). Corporate and NGOs' Voluntary Disclosure on Collaboration. Evidence from Poland, *Inżynieria i Gospodarka - Engineering Economics*, 27(1), 98-108.
- Hawrysz, L. (2016). Social Aspects of CSR Reporting In Polish Banks Listed On The Warsaw Stock Exchange, *3rd International Multidisciplinary Scientific Conference on Social Sciences & Arts SGEM*.
- Michalczyk, G. (2012), Aktywa niematerialne jako generatory wartości w spółkach notowanych na GPW, *Zarządzanie i Finanse*, 10,(4),49-63.
- Dobija, D. (2003). *Pomiar i sprawozdawczość kapitału intelektualnego przedsiębiorstwa*, Warszawa: Wydawnictwo Wyższej Szkoły Przedsiębiorczości i Zarządzania im. Leona Koźmińskiego.

- Sienkiewicz, Ł., & Trojanowska, M. (2015). Potrzeby informacyjne i stosowane obecnie w przedsiębiorstwach narzędzia pomiaru kapitału ludzkiego – wyniki badań empirycznych, in: Sienkiewicz Ł. (ed.) *Pomiar kapitału ludzkiego przedsiębiorstwa – perspektywy badawcze*, Polska Agencja Rozwoju Przedsiębiorczości, Warszawa
- Bagieńska, A. (2014). Raport roczny jako narzędzie pozyskania informacji o kapitale ludzkim przedsiębiorstwa – wyniki badań spółek z Respect index GPW S.A., *Przegląd Organizacji* 3/2014
- Dyduch J., & Krasodomska, J. (2017). Determinants of Corporate Social Responsibility Disclosure: An Empirical Study of Polish Listed Companies, *Sustainability*, 9, 1934
- Karmańska A., & Bareja K., (2014). Economic quality of intellectual capital in companies listed on the stock exchange. Verification of KL-ARK model, in: Dermol, V., Trunk, A., Đaković, G., % Smrkolj, M. (red.), *Managing Intellectual Capital and Innovation for Sustainable and Inclusive Society*, ToKnowPress, Bangkok
- Żarnik-Żuławska, J. (2016). Measurement of intellectual capital and market value of listed companies, *Journal of positive management*, 7(3), pp. 81-95.
- Tatarska, M. (2013). Integrated reporting on the example of the Lotos Group Joint Stock Company, in: Luty Z., Łakomiak A., & Mazur A., *Przyszłość rachunkowości i sprawozdawczości – założenia, zasady, definicje. Ujawnienia informacji w sprawozdaniu finansowym*. Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu, Wrocław
- Bek-Gaik, B., & Rymkiewicz, B. (2016). Tendencje rozwoju sprawozdawczości zintegrowanej w praktyce polskich spółek giełdowych, *Zeszyty Naukowe Uniwersytetu Szczecińskiego, Finanse, Rynki Finansowe, Ubezpieczenia* nr 1/2016 (79), pp. 767-783, DOI: 10.18276/frfu.2016.79-60
- Trocka, M. (2017). Ujęcie informacji o kapitale intelektualnym w sprawozdaniach przedsiębiorstw sektora informatycznego. *Ekonomiczne Problemy Usług*, 2 (127), 321–331. DOI: 10.18276/epu.2017.127-29.
- Wasilewska, M. (2017). *Wycena i raportowanie kapitału intelektualnego w spółkach giełdowych*, Praca doktorska: Wydział Zarządzania, Informatyki I Finansów, Wrocław, 2015
- Krasodomska, J. (2015). CSR disclosures in the banking industry. Empirical evidence from Poland, *Social Responsibility Journal*, 11(3), pp. 406-423, <https://doi.org/10.1108/SRJ-02-2013-0019>
- Hąbek, P. (2014) Evaluation of sustainability reporting practices in Poland, *Quality and Quantity*, 48, pp. 1739–1752. DOI 10.1007/s11135-013-9871-z
- Krasodomska, J. (2012). *Zintegrowana sprawozdawczość spółek w 2020 roku*. Zeszyty Teoretyczne Rachunkowości 66, pp. 101-110.
- Ocieczek, W., & Gajdzik, B. (2010). *Spółeczna odpowiedzialność przedsiębiorstw produkcyjnych*, Wydawnictwo Politechniki Śląskiej, Gliwice
- Jędrzejka, D. (2014). Ujawnienia ESG spółek notowanych na GPW w Warszawie a ich wyniki giełdowe, *Zeszyty Naukowe Uniwersytetu Szczecińskiego* nr 803, „Finanse, Rynki Finansowe, Ubezpieczenia” nr 66, Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin, pp. 331–343.
- Dumay, J. (2016). A critical reflection on the future of intellectual capital: from reporting to disclosure, *Journal of Intellectual Capital*, 17(1), pp. 168-184. <http://dx.doi.org/10.1108/JIC-08-2015-0072>
- Chiucchi, M. S. (2013). Measuring and reporting intellectual capital: lessons learnt from some interventionist research projects, *Journal of Intellectual Capital*, 14(3), pp. 395-413.
- Campbell, D., & Rahman, M. R. A. (2010). A longitudinal examination of intellectual capital reporting in Marks & Spencer annual reports, 1978–2008, *The British Accounting Review*, 42, pp. 56–70.
- Veltri, S. & Silvestri, A. (2015). The Free State University integrated reporting: a critical consideration, *Journal of Intellectual Capital*, 16(2), pp. 443-462.
- Abeysekera, I. (2013). A template for integrated reporting, *Journal of Intellectual Capital*, 14(2), pp. 227-245.

- Melloni, G. (2015). Intellectual capital disclosure in integrated reporting: an impression management analysis, *Journal of Intellectual Capital*, 16(3), pp. 661-680.
- Dumay, J. (2016). A critical reflection on the future of intellectual capital: from reporting to disclosure, *Journal of Intellectual Capital*, 17(1), pp. 168-184.
- Krippendorff, K. (2013). *Content Analysis: An Introduction to its Methodology*, Sage, Los Angeles, CA.
- Schaper, S., Nielsen, C., & Roslender, R. (2017). Moving from irrelevant intellectual capital (IC) reporting to value-relevant IC disclosures: key learning points from the Danish experience, *Journal of Intellectual Capital*, 18(1), pp. 82-101.
- Oliveira, L., Rodrigues, L. L., & Craig, R. (2006). Firm-specific determinants of intangibles reporting: evidence from the Portuguese stock market, *Journal of Human Resource Costing & Accounting*, 10(1), pp. 11-33.
- Bozzolan, S., Favotto, F. & Ricceri, F. (2003). Italian annual intellectual capital disclosure: an empirical analysis, *Journal of Intellectual Capital*, 4(4), pp. 543-558.
- Guthrie, J., & Petty, R. (2000). Intellectual capital: Australian annual reporting practices. *Journal of Intellectual Capital*, 1(3), pp. 241-251.
- Brennan, N. (2001). Reporting intellectual capital in annual reports: evidence from Ireland. *Accounting, Auditing & Accountability Journal*, 14(4), pp. 423-436.
- Bontis, N. (2003). Intellectual capital disclosure in Canadian corporations, *Journal of Human Resource Costing & Accounting*, 7(1), pp. 9-20.
- Xiao, H. (2008). Corporate reporting of intellectual capital: evidence from China. *The Business Review*, 11(1), pp. 124-129.
- Yi, A., & Davey, H. (2010). Intellectual capital disclosure in Chinese (mainland) companies. *Journal of Intellectual Capital*, 11(3), pp. 326-347.
- Singh, S. & Kansal, M. (2011). Voluntary disclosures of intellectual capital: an empirical analysis. *Journal of Intellectual Capital*, 12(2), pp. 301-318.
- Marr, B. (2003). Why do firms measure their intellectual capital? *Journal of Intellectual Capital*, (4), pp. 441-464.

ISO 9001:2015 as a driver to push Intellectual Capital and Knowledge Management

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Abstract: The purpose of this paper is to report on the status quo of implementation of KM- and IC related measures to improve quality management (as a function of organizational development) according to the requirements of ISO 9001:2015 in Germany. This paper builds on a web based national industry survey that was repeated as a longitudinal study over a period of 3 years between 2015 and 2018. It is supported with a Delphi approach to inquire on both, challenges as well as remedies to support enterprises on the management of IC as well as to investigate on reasonable interpretations regarding the new requirements of ISO 9001:2015. Auditors as well as industry experts are currently working on the establishment of a shared understanding in order to support competitiveness of the enterprises and the economy. New requirements of standards are implemented over a transition period. This paper covers three years between the first communication and early experiences with new requirements of ISO 9001:2015 in two dimensions: the communication and understanding of requirements as well as progress in implementation. This paper builds on the standard literature in knowledge management (e.g. Spender, J.C.; Bratianu, C.; Kianto, A.), knowledge strategy (Grant, R.), innovation (Viedma, J.M.) as well as established ideas on quality management in the context of business excellence (EFQM, ISO). Because of the high relevance that ISO 9001 presents for certified enterprises, changes in requirements have an impact on several levels of the economy: the standards per se constitute a regulatory framework and serve as guidelines on a macro level; implementing those requirements is supported by various (national) associations who support their members – industry as well as consultants – to implement measures to manage the knowledge base and, eventually, audit the progress. The survey results highlight a modest readiness of the industry to comply with the new requirements. Building awareness to shift priorities is thus a highly relevant priority.

Keywords: Industry practice of KM; organizational development; management method implementation; entrepreneurship

1 Introduction

Both, knowledge management and quality management are established in the management literature for decades and show continuous development (Deming, 1943; Juran, 2010; Edvinsson, 1997; Viedma, 2001; Spender, J.C. 2014; Grant, R. 2010). However, the professional implementation and standardization of quality management has a substantial advance, particularly in German speaking areas, where TÜV was established in 1869. Comparably new institutes, such as Deutsche Gesellschaft für Qualität dgq, were founded in 1952 while professional associations for knowledge management – Gesellschaft für Wissensmanagement GfWM - were established only 20 years ago. With advancement of the knowledge society (Drucker, 1993) into “digital” or the “internet for things”, intangible assets made it into the list of new requirements, in particular into the ISO 9001 series (ISO, 2015). More than 50.000 organizations are certified according to ISO requirements (Petrick, K. and Graichen, F. 2012). EN ISO 9001 defines the minimum requirements for a quality management system (QM system) that an organization must meet in order to be able to provide products and services that meet customer expectations and official requirements. At the same time, the management system should be subject to a continuous improvement process – which is where the new requirements from 2015 fit in.

1.1 New requirements of ISO 9001:2015

ISO9001:2015 includes the management of knowledge and competencies in the list of requirements for certification. This makes sense, as prior studies reported on moving into professional utilization of knowledge as a resource (Alwert et. al., 2011). The norm essentially differentiates these terms and then follows the structure of requirements:

- Both, knowledge and competencies need to be defined.
- Both need to be continuously maintained and
- Employees need to be trained in these competencies.
- Finally, organizations should establish procedures to acquire additional knowledge and competencies in order to keep their market positions.

1.2 Standards as vehicle to push management practices

Narratives of market leaders and their managers, such as the famous Jose Ignacio Lopez from Volkswagen, who revolutionized not only this company, but via the means of his purchasing power in the value chain, effectively enforced the implementation of quality management standards in the automotive industry, are firmly established in management textbooks. And while there is plenty of critique available for knowledge management and its derivatives such as intellectual capital management (Dumay, 2017; Bratianu, 2015), there remains the opportunity to push this topic by communicating its methods, demonstrating its applicability and – ultimately – its benefits in establishing an excellent organization.

2 Challenges

This timeline-survey aims to identify the uptake of changes by ISO 9001: 2015 in enterprises with a special focus on knowledge and competencies over a period of three years from 2015 to 2018 (Bornemann et al, 2016; Bornemann et al 2018). Additionally, the authors would like to assess spread and use of knowledge management methods in order to better support research and implementation of knowledge management practices (e.g. Brecht et al 2016).

2.1 Terminology

One of the changes in the ISO 9001 taxonomy is the differentiation of terminology. From the knowledge management perspective, the interesting part is the explicit mentioning of “knowledge” and “competencies”, which moves the topic from an obscure minority interest to official requirements. While the ISO 9001 does not explicitly offer a definition of knowledge, DIN SPEC 91281:2012-04 does:

Knowledge: All the knowledge and skills that individuals use to solve problems based on data and information, but which, unlike data and information, are always linked to individuals.

The same source offers a definition of competencies:

Competence: Ability to apply knowledge and skills to achieve intended results (cf. DIN EN ISO 9000:2015-11) (see: DIN EN ISO 9000:2015-11)

In the understanding of the norm, there is a clear hierarchy, where competency includes knowledge and therefore represents a higher form of understanding that enables “action”. This definition constitutes a potential source of misinterpretations among German speaking managers, where the exact meaning and definition might differ. Fortunately, this can be tested by asking organizations about their understanding.

Question 1: The ISO 9001:2015 standard makes an explicit distinction between the requirement areas of "dealing with knowledge" and "dealing with competence". Does this distinction matter to you?

2.2 Familiarity with norms

Changing requirements face a simple but general challenge: the communication process to update to the most current version. ISO norms are proprietary and thus not publicly visible. However, auditors as well as enterprises can easily subscribe to these texts via the ISO-website or their national agencies. These costs constitute a small barrier but can be overcome. A more severe barrier is established by identifying changes in requirements. Again, national agencies such as dgq, dqs, TÜV and others offer seminars and training to communicate the changes, supported by digital media – on the level of headlines, not on the level of the text and the interpretation of requirements.

The general topic of proprietary standards and open source requirements should not be addressed here, as it constitutes the business model for certifying institutions. However, in terms of knowledge transfer, sharing experiences and collaborating with adjacent disciplines, this constitutes a constraint.

The following research questions are therefore related closely to the norm:

Question 2: How well are you aware of the current requirements of ISO 9001 regarding the handling of knowledge and competences?

2.3 Status of accomplishment

Even though several requirements of ISO 9001:2015 are new in the norm, the management practices are not new for many organizations. The transition period was set for three years, until the new requirements must be accomplished. Thus, with this survey the readiness of organization for knowledge management should be assessed.

The following questions are therefore related closely to the norm – see section 1.2 – and follow the same pattern for “knowledge” as well as “competencies”:

- How good are the (above identified) requirements regarding “knowledge” already fulfilled?
- How good are the (above identified) requirements regarding “competencies” already fulfilled?

The questions are reported together with the responses in the data section.

2.4 Utilization of knowledge management methods and instruments

These questions focus on the idea to better help both associations – dgq and GfWM – to better support their stakeholders in meeting the challenges of knowledge management.

Question 14: What challenges do you see for the implementation of the requirements?
Multiple answers possible.

In order to gain some understanding on the knowledge management methods in use, a set of methods is presented and asked to what extent they are part of regular procedures.

2.5 Demographics

Respondents were asked some questions in order to better understand the background. The questions relate to company size, industry and prior experiences with quality management certification processes.

3 Data and Analysis

The research questions were originally developed in 2015, when the then new norm was published by a joint team of two professional associations representing experts from knowledge management as well as from quality management background.

The survey was set up as an online questionnaire and sent to enterprises selected from a mailing list of dgq as well as to the recipients of a newsletter of GfWM. The original mail reached at least 1600 (dgq) and 600 (GfWM) recipients as a direct online invitation. In addition, a link to the survey was available on the websites of the two groups. In 2015, 90 responses could be included in the first round of analysis.

At the end of 2016, the survey was repeated to determine whether there were significant changes in understanding and dealing with the standard requirements in terms of knowledge and competences in the first year after the revised standard came into force. 215 questionnaires were included in the analysis.

The third survey was open from October to December 2017. The questionnaire was shortened in order to reduce the effort required for the survey respondents. There was no longer any question as to whether the new texts in the 2015 standard are clear or "understandable" - the statements in the first two surveys were (positively) stable. 138 data records were included into this analysis.

3.1 Sample distribution

The large majority of respondents are from producing industry (ranging from 52%-59% between 2015 and 2017), a substantial part from services (15%-18% between 2015 and 2017) and an almost similar large share from healthcare and social organizations.

The size of organizations responding to this survey ranges from very small in both measures (number of employees and annual turnover) to very large, while about 40% of respondents did not position themselves in the financial category. Over the three years covered, the sample shows relative stability.

Table 1: What is the company size in annual sales?

What is the company size in annual sales?			
	2015	2016	2017
> 250 Mio €	19,8	12,8	20,9
50 Mio € to <250 Mio E	16,3	13,8	13,4
10 Mio € to <50 Mio E	12,8	22,2	19,4
< 10 Mio €	11,6	18,7	15,7
no answer	39,5	32,5	30,6

Table 2: What is the company size in number of employees?

What is the company size in number of employees?			
	2015	2016	2017
>10.000	15,9	3,9	5,8
5000-9999	9,1	3,4	8
1001-5000	18,2	22	16,1
501-1000	6,8	12,2	5,8
251-500	13,6	11,2	12,4
50-250	13,6	23,9	32,9
less than 50	17	22	16,1
no answer	5,7	1,5	2,9

Table 2: What is your industry background?

What is your industry background?	2015	2016	2017
Production / Manufacturing	56,8	52,4	59,1
Service	18,2	17	15,3
Health and social services	11,4	18,5	8,8
other	13,6	12,2	16,8

In 2017, more than half of the survey participants (56%) had no experience with re-certification according to the new requirements of ISO 9001:2015, while 41% already recertified. The rest did not answer.

3.2 Terminology

Table 3: Does the distinction between “knowledge” and “competencies” matter to you?

The ISO 9001:2015 standard makes an explicit distinction between the requirement areas of "dealing with knowledge" and "dealing with competence". Does this distinction matter to you?	2015	2016	2017
I believe that this distinction is correct and helpful	56,7	50,47	51,5
I can understand this distinction, but it seems to me practically impossible to make	28,9	37,38	39,9
I can't do anything with that distinction	14,4	12,15	8,7

The distinction between knowledge and competences shows relatively stable statements over the years: while for one half the difference is clear, the other half finds it difficult to work with it in practice. We will probably see this in the audits from autumn 2018.

3.3 Familiarity with norms

Table 4: How well are you aware of the current ISO 9001 requirements regarding the handling of knowledge and competencies?

How well are you aware of the current requirements of ISO 9001 regarding the handling of knowledge and competences?	2015	2016	2017
Precisely known	10	21,4	32,61
Rather well known	27,77777778	46,98	40,58
Moderately known	42,22222222	23,72	23,19
Rather unknown	12,22222222	7,44	2,9
Completely unknown	7,77777778	0,47	0,72

The level of awareness of the standard has shown continuous improvement since 2015. The information measures seem to be working. The deadline for the changeover is also approaching, so that the work on the standard can no longer be delayed.

3.4 Status of accomplishment

For the above introduced questions, the following data related to “knowledge” and – below – to “competencies” can be reported.

Table 5: The organization must determine the knowledge required to carry out its processes and to achieve the conformity of products and services.

The organization must determine the knowledge required to carry out its processes and to achieve the conformity of products and services. How well does your company currently meet this specific requirement?			
	2015	2016	2017
very well fulfilled	35,8139535	5,12	5,12
well fulfilled	32,0930233	35,81	35,81
mediocre	13,0232558	32,09	32,09
was poorly fulfilled	7,44186047	13,02	13,02
badly fulfilled	5,58139535	7,44	7,44
has not yet been fulfilled	5,11627907	5,58	5,58
I do not know	0,93023256	0,93	0,93

Even if the responses appear stable, there is a continuously more critical assessment. The proportion of "rather poorly fulfilled" increases by half in relative terms and thus probably shows a growing awareness both of the requirements and of the points that are still open.

Table 6: The necessary knowledge must be maintained.

The necessary knowledge must be maintained. How well does your company currently meet this specific requirement?			
	2015	2016	2017
very well fulfilled	6,7	10,2	8
well fulfilled	35,6	31,6	26,8
mediocre	24,4	37,2	39,1
was poorly fulfilled	16,7	12,6	15,2
badly fulfilled	8,9	5,1	9,4
has not yet been fulfilled	4,4	2,3	1,5
I do not know	3,3	1	0

Compared to 2015 and 2016, we see a more critical assessment of the fulfilment of the requirements for the maintenance of knowledge. The proportion of "mediocre fulfilment" is increasing but cannot compensate for an overall higher need for action.

Table 7: The required knowledge must be imparted to a sufficient extent.

The required knowledge must be imparted to a sufficient extent. How well does your company currently meet this specific requirement?			
	2015	2016	2017
very well fulfilled	10	12,6	5,8
well fulfilled	35,6	31,2	28,3
mediocre	35,6	39,1	44,9
was poorly fulfilled	11,1	12,1	11,6
badly fulfilled	2,2	1,9	8,7
has not yet been fulfilled	2,2	1,9	0,7
I do not know	3,3	1,4	0

The share of "very good fulfilment" in knowledge transfer (impartment) is halved in 2017 and "good fulfilment" is also falling. More than 20% (11.6%+8.7%) of the responding organizations see a clear need for action to impart knowledge sufficiently.

Table 8: The organization must determine how the necessary additional knowledge is acquired.

The organization must determine how the necessary additional knowledge is acquired or how it is accessed. How well does your company currently meet this specific requirement?			
	2015	2016	2017
very well fulfilled	8,9	3,3	4,4
well fulfilled	21,1	26,5	23,9
mediocre	41,1	38,6	40,6
was poorly fulfilled	11,1	18,1	17,4
badly fulfilled	10	7,5	8
has not yet been fulfilled	4,4	4,7	5,8
I do not know	3,3	1,4	0

Obtaining the "necessary additional knowledge" is only very good and good for about 30% of the responding organisations - and represents a central challenge. Over time, this topic has been rated relatively stable.

Table 9: How well is the entire "knowledge management" requirement area already fulfilled in your company?

How well is the entire "knowledge management" requirement area already fulfilled in your company?			
	2015	2016	2017
very well fulfilled	5,6	3,3	2,9
well fulfilled	32,2	28,8	23,2
mediocre	33,3	42,3	47,8
was poorly fulfilled	16,7	16,3	15,9
badly fulfilled	6,7	6,5	8,7
has not yet been fulfilled	1,1	2,3	1,5
I do not know	4,4	0,5	0

Uncertainties in "managing knowledge" increase over time and are certainly a "big challenge" when it comes to standard requirements.

The same structure of questions was surveyed for the topic of "competencies". The following data related to "competencies" can be reported.

Table 10: The organization must determine the necessary competencies for all persons who carry out activities under its supervision which influence the quality performance of the organization.

The organization must determine the necessary competencies for all persons who carry out activities under its supervision which influence the quality performance of the organization.			
	2015	2016	2017
very well fulfilled	6,7	9,8	8,7
well fulfilled	46,7	39,5	29,7
mediocre	17,8	29,3	40,6
was poorly fulfilled	12,2	12,1	14,5
badly fulfilled	6,7	5,6	2,9
has not yet been fulfilled	6,7	1,4	3,6
I do not know	3,3	2,3	0

The pioneers are relatively stable in determining the required competencies at just under 10%, while the proportion of "good fulfilment" is falling over time.

Table 11: The organization shall ensure that such persons are actually competent on the basis of appropriate training, education or experience. How well does your company currently meet this specific requirement?

The organization shall ensure that such persons are actually competent on the basis of appropriate training, education or experience. How well does your company currently meet this specific requirement?			
	2015	2016	2017
very well fulfilled	15,6	16,3	8
well fulfilled	47,8	40,9	50
mediocre	18,9	26,5	30,4
was poorly fulfilled	3,3	9,3	7,3
badly fulfilled	5,6	5,1	2,2
has not yet been fulfilled	3,3	0,9	2,2
I do not know	5,6	0,9	0

Ensuring that the educational requirements are met is stable, even if the proportion of very good fulfilment is significantly reduced. For a total of more than 40% of the responding organizations, there is still high potential for development.

Table 12: The organization must, if necessary, take measures to acquire the competences still required.

The organization must, if necessary, take measures to acquire the competences still required. How well does your company currently meet this specific requirement?			
	2015	2016	2017
very well fulfilled	14,4	14,4	10,1
well fulfilled	38,9	40,9	41,3
mediocre	26,7	30,3	29
was poorly fulfilled	7,8	9,8	14,5
badly fulfilled	4,4	2,3	2,3
has not yet been fulfilled	4,4	1,9	2,9
I do not know	3,3	0,5	0

More than 50% of the responding organizations already fulfil the measures for the acquisition

of competences very well or well. At the same time, the share of organizations with rather poorly assessments is rising to 20% overall.

Table 13: The organization must assess the effectiveness of the measures taken to acquire competence.

The organization must assess the effectiveness of the measures taken to acquire competence. How well does your company currently meet this specific requirement?			
	2015	2016	2017
very well fulfilled	10	7	5,8
well fulfilled	21,1	19,5	18,1
mediocre	32,2	36,3	33,3
was poorly fulfilled	15,6	20	25,4
badly fulfilled	11,1	12,1	10,1
has not yet been fulfilled	4,4	3,7	7,3
I do not know	5,6	1,5	0

Fulfilment is seen much more critically in assessing the effectiveness of competence acquisition measures. Check, or C - in the context of PDCA - is only done well / very well by a quarter, more than 43% of the responding organizations need action.

Table 14: The organization must retain appropriate documented information as proof of competence.

The organization must retain appropriate documented information as proof of competence. How well does your company currently meet this specific requirement?			
	2015	2016	2017
very well fulfilled	22,2	22,8	13
well fulfilled	33,3	33,5	44,2
mediocre	16,7	25,6	25,4
was poorly fulfilled	10	10,7	10,4
badly fulfilled	4,4	3,7	2,2
has not yet been fulfilled	4,4	2,8	2,9
I do not know	8,9	0,9	1,5

The documentation of competencies is assessed as stable compared to the previous year, even though the share of "very good fulfilment" has fallen significantly from 23% to 13%. This topic seems to benefit particularly from already well-established management procedures and routines.

Table 15: How well has the entire requirements area of "dealing with competences" already been fulfilled in your company?

Dealing with competencies: How well has the entire requirements area of "dealing with competences" already been fulfilled in your company?			
	2015	2016	2017
very well fulfilled	4,4	4,2	4,4
well fulfilled	33,3	37,7	37
mediocre	42,2	37,2	35,5
was poorly fulfilled	7,8	15,4	15,9
badly fulfilled	5,6	2,3	6,5
has not yet been fulfilled	1,1	2,8	0,7
I do not know	5,6	0,5	0

The handling of competences is evaluated as critically as the handling of knowledge. Over time, there is a very high degree of stability - and thus a continuing need for action - if excellence and strategic differentiation are to be striven for. Given the high attention allocated for the “new requirements”, we observe very limited change (or improvement).

As control questions for the reliability of the assessment of the status quo in terms of already fulfilling the requirements of the standard, the following question confirms the data gathered so far.

Table 16: How great do you estimate the need for your company to fulfil the requirements of the new standard with regard to the handling of knowledge and competences?

How big do you estimate the need for your company to fulfil the requirements of the new standard with regard to the handling of knowledge and competences?			
	2015	2016	2017
very great need for action	14,8	13,1	13,8
great need for action	28,4	28,2	25,4
medium action needs	37,5	42,7	33,3
little need for action	11,4	12,6	20,3
no need for action	2,3	1,5	6,5
I do not know	5,7	1,9	0,7

The control question on the presumed need for action confirms the previous assessment. 27% expect little or no action to be taken, while more than 70% of the responding organizations need to become more active.

Table 17: What challenges do you see for the implementation of the requirements?

What challenges do you see for the implementation of the requirements?			
	2015	2016	2017
Filling the requirements with life	61,3	70,2	57,8
Lack of resources	54,7	50,7	48,9
Communicating the requirements to the employees	52,6	50,7	61,1
vague responsibilities	31,4	37,6	30
others ...	8,8	10,2	8,9
I do not know	0,7	2	6,7

The order of the challenges in the implementation remains stable compared to the previous year. Filling the requirements with life is still central, even if success is already evident here. The communication of the tasks seems to work better in the meantime.

3.5 Utilization of knowledge management methods and instruments

In order to gain a better understanding about how the business community is interpreting knowledge management, they were asked to identify methods and the level of their implementation. A maturity scale starts with “no intention to apply” and a planning stage, two stages of implementation until “high(est) effectiveness” is accomplished.

Table 18: Which of these practices are currently being implemented in your company or are planned (2017)

Which of these instruments are you currently implementing or planning to implement?					
	We do, it is very effective	we do, it is partly effective	we do, but it is not effective	is in planning	we don't do this
document management system	30,5	37,4	10,7	10,7	10,7
systemic personnel development	24,6	38,8	9,7	10,5	16,4
self-explanatory folder structure	22,1	34,7	14,2	7,1	22,3
project databank	21,4	29	14,5	4,6	30,5
knowledge transfer process	12,1	33,3	8,3	13,6	32,6
best practice	17,1	35,7	9,3	4,7	33,3
E-Learning / Blended Learning	16,7	29,6	3	9,1	41,7
Expert database / Employee profiles	7	23,3	13,2	12,4	44,2
wiki	13,9	20	9,7	8,5	48,5
expert circles / rounds of experience	17,3	25,2	2,4	6,3	48,8
search engines	16,9	21,5	8,5	3,1	50
development partnerships	9,6	24,8	7,2	6,4	52
content management system	9,2	19,2	8,3	10	53,3
knowledge-oriented processes	6,9	15,4	3,9	16,9	56,9
knowledge assurance / expert debriefing	8,1	19,4	4,8	9,7	58,1
event formats / Knowledge marketplace	8,4	18,3	3,1	6,1	64,1
groupware Systems	6,6	13,9	7,4	5,7	66,4
knowledge maps	4,8	7,3	4,8	14,5	68,6
intellectual capital reporting	2,3	10,9	6,3	10,2	70,3
blog / microblog	3,2	9,6	4,8	8,8	73,6
knowledge manager	3,3	6,5	4,1	9,8	76,4
knowledge audit	1,6	4	4,8	7,9	81,8

4 Findings and Discussion

4.1 Terminology and Definitions

Based on three years of survey data, the current level of a “shared language” or terminology is both, comparatively stable and bipartisan. While a very small majority of 51% of respondents confirm the benefits of differentiation between knowledge and competencies, about 40% see challenges in enforcing this differentiation, while about 10% cannot relate to this differentiation.

The handling of the topic block "knowledge" causes the interviewees greater difficulties than that of "competences". A possible explanation could be the general use of terms. In the context of "competence management", there are often conceptual connection possibilities to human resources and employee competence development, which are basically designed in many organisations. In contrast, the numerous methods of knowledge management are often

and erroneously reduced to "IT and documentation". Questions such as how new knowledge is created, how it is distributed and preserved and how the very demanding and complex knowledge is kept up-to-date are often left unanswered. The focus of the revised ISO 9001:2015 standard has also helped to raise awareness of this problem.

4.2 Implementation of new requirements

The terms knowledge and competence became increasingly familiar to the participants in the course of the 3 years. "Exactly familiar" or "well familiar" with the terms are now 63% of participants instead of 28%.

With regard to the assessment of compliance with the standard requirements, there have been some significant changes over time. While some participants were still very optimistic in the first round (2015), the more intensive discussion of the requirements and the actual work on implementation probably caused a certain relativisation in the following years. Instead of 10% in 2015, currently (2017) only 6.5% of respondents see the requirements very well fulfilled.

So far, only 4.5% of the participating companies have already "very well fulfilled" the entire "knowledge management" requirement area in their company. Over the three years, there has been a very high degree of stability in the statements and evaluations. One interpretation could be that already 3 years ago knowledge was consciously developed as a resource and therefore no change can be seen. The alternative interpretation, however, is that the new requirements of the ISO standard have not led to any particular changes. (The third option remains: both the demand for knowledge management and the state of implementation have developed equally).

Uncertainties in "handling knowledge" increase over time (from 38% to currently 25%) and are certainly a big challenge in terms of standard requirements. If one considers the requirements for "knowledge" (determining knowledge, imparting knowledge, maintaining knowledge, building up additional knowledge), the degrees of fulfilment for "acquiring additional knowledge" are relatively stable. However, there is still a big need for action. For the subrequirements "determine knowledge", "maintain knowledge" and "impart knowledge", the responses tend to shift from "very well fulfilled" or "well fulfilled" to "moderately fulfilled" over time.

The greatest need for action arises over a period of three years from "assessing measures for the acquisition of competencies". The fulfilment levels shift from "very well fulfilled" or "well fulfilled" to "moderately fulfilled" and worse.

4.3 Recommendations

For the first time, participants were also asked about the application or planned implementation of 22 selected knowledge management tools. These are classic examples with which the requirements of the standard can be fulfilled. In relation to the selected knowledge management tools, there is a slight tendency to use technical systems (document management system, self-explanatory folder structure, project database, etc.). Some of these

are rated at high percentages with "we do this very effective" or "we do this, it is partly effective".

It should be noted that technical systems merely codify knowledge. However, since knowledge is always bound to people (cf. also DIN SPEC 91281:2012-04), a wrong emphasis may be placed here. Technical systems can support, but not replace, the direct exchange between people (employees) - learning from and with each other proper "dealing with knowledge" must embrace communication AND documentation. Against this background, a review of the measures/strategies/methods used or planned also seems to make sense.

If we place the statements of this study in the larger context of the digitization of business models and the increasing automation as well as the still extremely easy availability of financial capital, there is a need for action, especially from a strategic point of view, not only for the "large" but also for medium-sized companies and for knowledge-intensive SMEs, in order to make good use the opportunities and minimize probable risks. It is highly advisable to deal with the basic tools for knowledge management and to integrate them carefully into the routines of the organisation.

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References

- Alwert, K., Bornemann, M., Meyer, C., Will, M., Wuscher, S. (2011). *Studie „Wissensstandort Deutschland“ - Deutsche Unternehmen auf dem Weg in die wissensbasierte Wirtschaft*; Ergebnisse 2011: Hrsg: Bundesministerium für Wirtschaft und Technologie/Arbeitskreis Wissensbilanz/ Fraunhofer IPK. www.akwissensbilanz.org
- Bornemann, M., Brecht, A., Hartman, G. (2018). *ISO 9001:2015: Anforderungen im Umgang mit Wissen und Kompetenzen – Statusabfrage 2017*; Deutsche Gesellschaft für Qualität und Gesellschaft für Wissensmanagement. Frankfurt a.M.
- Bornemann, M., Brecht, A., Grefe, L., Wiktor K. (2016). *ISO 9001:2015: Anforderungen im Umgang mit Wissen und Kompetenzen – Statusabfrage 2016*; Deutsche Gesellschaft für Qualitätsmanagement und Gesellschaft für Wissensmanagement. Frankfurt a.M.
- Bratianu, C. (2015): Challenges for the University Intellectual Capital in the Knowledge Economy. *Management Dynamics in the Knowledge Economy*, Vol.3 (2015) no.4, pp.609-627.
- Brecht, A.; Bornemann, M.; Hartmann, G.; Keller, Ch.; Röllecke, Th., Schmidt, O.; Soyez, N.; Vollmar, G.; Weubel, M.; Wiktor, K. (2016): *Praktische Orientierung fuer Qualitätsmanagementverantwortliche*. Deutsche Gesellschaft für Qualität und Gesellschaft für Wissensmanagement. Frankfurt a.M.
- Drucker, P.F. (1993), *The rise of the knowledge society*. Wilson Quarterly Vol. 17. No. 2, pp. 52-70.
- Deming, W. Edwards (1964) [1943]. *Statistical Adjustment of Data*. Dover.

Dumay, J. (2009). Reflective discourse about intellectual capital: Research and practice. *Journal of Intellectual Capital*, 10(4).

Edvinsson, L. and Malone, M. S. (1997), *Intellectual Capital: Realizing Your Company's True Value by Finding Its Hidden Brainpower*, Harper Business, New York.

Grant, R. (2010): *Contemporary Strategy Analysis*, Wiley.

ISO (2015): *Quality management principles*. Geneva.

Juran, J. M. and De Feo, J.A. (2010): *Juran's Quality Handbook*, 2010.

Petrick, K. and Graichen, F. (2012): 25 Jahre ISO 9001: Erfolgsweg einer Systemnorm. In: *Qualität und Zuverlässigkeit*. 57. Jg., Nr. 3, p. 26–28.

Spender, J.C. (2014): *Business Strategy. Managing Uncertainty, Opportunity & Enterprise*. Oxford.

Sveiby, K. (1997), *The New Organizational Wealth*, San Francisco.

Viedma, J.M. (2001), ICBS Intellectual Capital Benchmarking System, In: *Journal of Intellectual Capital*, 2, p. 148–164.

Knowledge Management

Constantin Bratianu

In the last decades knowledge became a strategic resource for business and managing knowledge constitutes a challenge for practitioners as well as for researchers in the field. Knowledge Management is a new field of research and although there are many international journals and conferences dedicated to this phenomenon it still needs efforts and creativity to discover the laws which govern its complexity and dynamics. This stream aims at being a forum of sharing our new ideas and research results about knowledge and knowledge management.

Knowledge management in the companies which deliver new industrial solutions

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Abstract: The field of knowledge management contains ways and methods used to gain or create, store and distribute knowledge within or to another organization (knowledge and technology acquirer). This field is especially important when a production organization is faced with difficulties connected with make or buy decision and the question: “to buy new, usually expensive, technology or to use resources of external contract manufacturer”. There are entities (knowledge organizations, knowledge transferors) which supply manufacturers with knowledge and new industrial solutions like new technology. In these entities knowledge is perceived as a strategic asset that needs to be generated, stored, transformed, sold and transferred to customers (in this case – to manufacturers). Knowledge management is also treated as an essential tool for preserving, maintaining and empowering the intellectual capital of the organization. Because of that suppliers of new industrial solutions implement various methods to generate, share and exploit knowledge. They focus on building intellectual capital, recruiting specialists and experts, staff trainings, skills improvement, development of knowledge management procedures. Their target is to be well prepared to offer new technology (together with precise information and necessary data) to manufacturers which are potential users of this technology. The question is which methods are used most often.

Keywords: make-or-buy decisions, knowledge management, knowledge transfer, Intellectual Capital

1. Introduction

The make or buy decision is the first step in analysis carried out to evaluate which option of business may be appropriate in the future and which technology may dominate future market. There are many academic publications which show benefits and disadvantageous of outsourcing and insourcing. There are also many researches connecting this field with offshore decisions. For many enterprises the key factor is cost reduction. For technology suppliers the basic question is how to build own intellectual capital to be able to create or develop new solutions which will be attractive for manufacturers (potential buyers).

2. Make-or-buy decisions

The external environment, over which companies have little or no influence, is very often the source of make-or-buy dilemma. Considering strategic choices of actual industrial leaders, many manufacturers must make the choice between internal or external resource using. For example, increased competition and market pressure in terms of low prices, commonly force companies to reduce costs. In many cases this pressure is the key reason for carrying out a make-or-buy review of a strategy (Peruta 2017). Decisions whether to make or to buy are especially complex in the one of the most compound environment, namely manufacturing area, where we may observe serious dilemma connected with capital spending; to make or to buy: equipment, technology, buildings, other infrastructure elements etc. The make-or-buy dilemma arises when a manufacturer must decide whether to produce goods internally or to purchase them externally. This typically is an issue when a company has the ability to manufacture material inputs required for its production process that are also available for purchase in the marketplace, for example, a computer company may need to decide whether to manufacture circuit boards internally or purchase them from a supplier (Wilkinson 2013).

When taking a make-or-buy decision, it is necessary to look at several factors, which must be carefully analyzed. Such decisions universally depend on the price of technology which must be acquired, costs of transport of supplied components, costs of different logistics solutions, possibilities of selling new products (risk connected with lack of demand) etc. The decision to make or to buy has a significant impact on a company's capital needs and also on operating cost structure (cost structure of potential external contract manufacturer and cost structure of in-house manufacturing capability). Evaluated costs should include the price of the product under consideration as it is being priced by suppliers offering the product in the marketplace for sale (Wilkinson 2013). The analysis must examine all of the costs related to purchasing materials and manufacturing the product as well as all the costs related to purchasing the ready product. Analysis may also include fixed and variable costs that usually are compared when decision about outsourcing is to be made. The cost of outsourcing of production process must not be underestimated. There are always hidden costs, which are not, as may initially seem, just the unfortunate coincidence. Other relevant costs may be resulted in:

- expanded inventory (ready products or modules, instead of raw materials),
- more intensive shipping and handling,
- additional administrative expenses,
- supervising external manufacturers (for example additional or more detailed quality control).

There are also other factors which should be analyzed (impact of outsourcing on capital expenditures, return on invested capital, and return on assets). As a result, in many cases, make or buy decisions have been overwhelmingly based on the simple cost per unit approach, without taking into account matters of a strategic or technological concern (Peruta 2017). In a consequence strategic implications tend to be ignored, and the strategic comparisons themselves are prone to distortion (Probert 1993). Simple cost-benefit analysis is not sufficient in this case, since the process of outsourcing brings into play all the issues linked to for example risk of loss of internal knowledge (Peruta 2017). The outsourcing trade-off

between capital cost savings and increased operating expenses depends on a number of factors, including:

- type of product,
- development stage of the product,
- strategic fit for in-house manufacturing and an organizational or cultural bent towards in-house manufacturing or outsourcing (White Paper 2017),
- technical description of manufacturing process,
- scale of manufacturing,
- outsourcing feasibility,
- availability of the product and the quality of the product offered by external contract manufacturers,
- risk level – escape of intellectual property, problems with data security, selecting poor supplier (in this case external manufacturer) bringing lower quality, bad reliability and predictability, finally bringing reputational risk (Gilmore 2017).

It may be shortly summarized by asking two questions:

1. Which products or services that are currently being bought by the company should be done in-house?
2. Which products and services that are currently being done in-house should be bought from external manufacturers? (White Paper 2017).

Table 1: Pillars of make-or-buy decision-making

	Make (in-house)	Pillars	Buy (outsource)
Business strategy	<p>In-house process differentiates the product or service</p> <p>Capability has synergies across the business</p> <p>Supply market (potential external contract manufacturer) is hostile or controlled by competitors</p>	<p>Attractiveness of the process/business</p> <p>Criticality for overall business success</p> <ul style="list-style-type: none"> · Proprietary processes · Product differentiation <p>Industry dynamics and dynamics of the technology</p> <ul style="list-style-type: none"> · Rate of change · Risk to core capabilities 	<p>Process/business is unattractive (e.g., hard to find workers, strict regulatory environment)</p> <p>Materials or processes are not critical to end products or marketing efforts</p> <p>Supply market is suitable for building close partnerships</p> <p>Suppliers are willing and able to meet innovation needs</p>
Risks	<p>Few or no alternative sources of supply</p> <p>High supply market risks</p> <p>Imperative to couple supply and usage (real-time/short lead time) for quick response or quality</p>	<p>Holdup risks</p> <p>Availability of alternative sources and switching costs</p> <p>Supply market risks</p> <ul style="list-style-type: none"> · Political stability · Mergers and acquisitions made by competitors <p>Transportation risks</p> <ul style="list-style-type: none"> · Lead times 	<p>Holdup risk is low or sufficiently managed through contract of broader business relationship</p> <p>Low switching costs and easily accessible alternative sources of supply</p>

	Sensitive intellectual property involved in process/product	· Supply disruptions Intellectual property protection	Uncoupling the supply chain has little impact No sensitive intellectual property involved
Economic factors	Internal cost advantage or cost parity Significant recent investment in process technology that cannot be recovered Investments meet required return on invested capital Company has strong, defensible skills base	Relative economic and operating performance advantage · Scale and utilization · Efficiency · Reliability · Factor costs · Quality Capital requirements and financial returns Level of skills and expertise	Suppliers have lower costs or better quality Major new investments are required Suppliers have lower ROI targets Insufficient or weak in-house skills/capabilities; skills are difficult to acquire

Source: Hawkes and Schwarting (2011, p. 7)

Outsourcing tends to be a good choice when companies are seeking possibilities to (Gilmore 2017):

- eliminate the burden of capital or labour-intensive processes,
- gain flexibility to adjust output in response to changing demand,
- phase out management of operations,
- phase out the necessity of staff training,
- supervise fewer workers,
- gain access to new process or technologies,
- leverage external expertise.

Table 2: Road map for make-or-buy decisions

Assessment	Question	Possible outcomes
1. Manufacturing strategy compatibility	Does the product fit within the manufacturing strategy?	Make in-house
2. Total delivered costs	How do internal costs compare with external alternatives?	Invest to make in-house
3. Capacity	Is there available or potential plant capacity for in-house manufacturing?	Buy from contract manufacturer
4. Intellectual property exposure risk	What is the intellectual property risk of buying a product?	Invest to buy from contract manufacturer
5. Business case	What is the business case for making or buying a product?	Invest to buy from contract manufacturer
6. Contract manufacturers availability	Are there contract manufacturers available to make the product?	Redefine or do not make the product

Source: Gilmore (2017)

Discussion about internal or external resource sourcing shows that the reality of business is very difficult. The reason is that the long-term outlook, regarding production or purchasing

the product, restricts the possibility of changing or altering the decision in the future and the likelihood of changing or reversing the decision at a future date (Wilkinson 2013). Very often it needs in-depth analysis. It may include geographical advantage, cost advantage, technology advancement, quality, performance and productivity, compared to actual and future external benchmark if it is available. An important element is to determine how strategically valuable the manufacturing capability is to the company. Usually in-depth analysis must contain quantitative and qualitative factors. Quantitative factors (they can be calculated, quantified and finally compared) may include the availability of production facilities, production capacity, required resources, while qualitative factors include the reputation and reliability (they must be estimated, they require more subjective judgment and often need multiple opinions) (Wilkinson 2013). Qualitative factors often are connected with expected availability of technology, which contains (White Paper 2017):

- manufacturing technology requirements (does the external contract manufacturer use similar manufacturing technology?),
- manufacturing scale and quantitative capacity availability (can the external contract manufacturer meet demand?),
- competitive quality standards and possibilities of establishing strong process and manufacturing regimes for ordered elements,
- a potential to develop proprietary manufacturing technology,
- capability to enhance the company's ability to in-license new products,
- business model of potential external contract manufacturer.

Above-mentioned qualitative factors are proof that not only costs but also many other elements should be analyzed before taking make or buy decision. By concentrating almost exclusively on cost reduction, companies and even industries lose sight of the bigger picture, with sometimes drastic consequences (Peruta 2017). There are many examples of companies which after realizing offshore project and locating plants in distant, for example low-cost, countries (for example in China, Vietnam, Bangladesh or India) reduced costs but in the same time decreased their competitiveness. Strategic decisions in the field of manufacturing are connected with a very popular concept of relocation (transfer of activity to other, for example low-cost, countries). Pressure for cost reduction forced many manufacturers to look for a less expensive destination. In last two decades it became a real boom. Globalization and accompanied phenomenon of offshoring brought new world architecture of manufacturing resources location. Basically it was a consequence of a massive transfer of production means and resources from reach and developed economies to low-cost countries. The basic (but not the only) reason was looking for lower cost of manufacturing (lower wages, taxes, cheaper complementary services {for example financial}, lower cost of energy, longer time of working lasting sometimes much longer than 8 hours per day, sometimes lack of trades unions). Backers of this option argued that only jobs of "blue collar workers" would be relocated to low-cost countries. Jobs of "white collar workers" were to stay in developed countries. Nowadays it may be said that it is not true. An unexpected aspect of this phenomenon contained for example internationalization of research and development activity (R&D). It turned out that this activity may be successfully realized also in less developed countries (Álvarez et al. 2009). Many global corporations gained higher flexibility. This allows using

intellectual capital of citizens of many countries. Consequently in case of many multinational corporations there is an observable global dispersion of innovative and R&D activity. There are many examples of companies which relocated their R&D units to such countries like China or India (Álvarez et al. 2009). At the beginning of this process the range of tasks entrusted to foreign subsidiaries was rather limited. Their duties contained simple functions connected for example with quality control (of supplies or produced goods – due to guidelines prepared and delivered earlier by parent headquarter), minor corrects in product specifications or in production process (for example in the field of security of workers, but avoiding the core of technology). As time goes by, the range of tasks entrusted to foreign R&D units in low-cost countries started to be broader. For example General Motors, Motorola and some other companies (representing mainly electromechanical industry) opened their rightful R&D centres in China (Cheng 2004). Other examples of such companies are: Caterpillar, Daimler, General Motors, Honeywell, Siemens, IBM, and Matsushita (Brown 2009). All of them established rightful R&D centres outside their parent countries. Connections between decisions about relocation of manufacturing activity (offshore, onshore or reshore) and decisions make or buy (in-house activity or outsourcing) have been presented in table 3.

Decision about whether to make or buy goods and sometimes services is one of the most problematic for manufacturers. Having so many possibilities, many managers of manufacturing enterprises are tempted to choose a new option. For example instead of arduous offshore in-house production organization, in own plant located in a distant country (problems with logistics, delays, sometimes unreliable suppliers, lower quality standards etc.), managers start to look forward external resources of contract manufacturers, which may be located in any place in the world and could realize all processes.

Table 3: Taxonomy of international production strategies

Offshore	<i>In-house offshoring</i> Manufacturing process realized in own plants located in foreign countries	<i>In & out offshoring</i> Parallel manufacturing activity in own plants and realized by external contract manufacturers – in both cases in foreign country or countries	<i>Outsourced offshoring (also offshore outsourcing)</i> Manufacturing process realized only by external contract manufacturers located in foreign country or countries
Onshore	<i>In-house onshoring</i> Manufacturing process realized in own plants located in domestic country	<i>In & out onshoring</i> Parallel manufacturing activity in own plants in domestic country and in plants of external contract manufacturers also located in domestic country	<i>Outsourced onshoring</i> Manufacturing process realized only by external contract manufacturers located in domestic country
Reshore	<i>In-house reshoring</i> Return of a whole or part of manufacturing activity from foreign countries to own plants in domestic country	<i>In & out reshoring</i> Return of manufacturing activity to domestic country and its realization in own or external plants	<i>Outsourced reshoring</i> Return of manufacturing process to domestic country but using only resources of external (but also local) contract manufacturers

Source: Młody (2017, p.291); Aboutalebi (2017, pp. 29-31)

While recognizing that external manufacturers may be able to make products or semi-products as well or even better (usually faster and cheaper), there has been a feeling that it is a reasonable alternative. But on the other hand there is a long list of arguments for reshoring (Gilmore 2017):

- poor offshore supplier performance – 72%
- inability to realize cost advantage – 44%
- unfavourable customers perception – 28%
- time zone differences – 28%
- social beliefs – 17%
- government incentives – 11%

These arguments may be also strengthened by latest protectionist decisions of Donald Trump, who is arguing that strong America needs protective tariffs and higher customs duties (for example on steel and aluminium). Imminent trade war may be a strong argument for insourcing.

3. Drivers of insourcing

Traditionally there has been a natural inclination for manufacturers to keep as much in house as possible (Probert 1993). Due to Resourced Based View (RBV) a company's expertise in its core business compared to its competitors is the key to building valuable core skills and turning them into competitive advantage (Peruta 2017). A company's competitive advantage is grounded on how its skills and capabilities outperform its rivals. This is traditional point of view. Nowadays many enterprises use external resources. But even today there are many situations which may be a serious argument for in-house activity:

- production function is considered a core competency/capability,
- a product, a process or a function is critical to a company's performance,
- a company would prefer to do this in-house because it would give a strategic competitive advantage,
- a company would prefer not to produce particular product in-house, but it really doesn't have any other options (Gilmore 2017),
- with a focus on long-term perspective, there is the huge need for suitable tools that are necessary to manage external staff and competencies appropriately,
- revolving around questions such as Intellectual Property Rights, the scope of patents and the terms under which they can be transferred may be seriously limited (Peruta 2017),
- actual and future strategic value of technology (sample criteria for evaluating strategic value: manufacturing flexibility, expected profitability, asset utilization, expected sales growth, technical differentiations, contract manufacturers capability, proximity to markets, overall equipment effectiveness, defects per million).

The examples of core competencies which are kept in-house may be the system of investment outlay allocation in General Electric, supervision of technological processes (high heat treatment) in Heraeus, research activity in Pfizer (Obłój 2016). Other drivers of insourcing may be connected with anything that threatens safety and continuity of manufacturing process realized by external contract manufacturers. It also may be connected with potentially disadvantageous situations when:

- an involved external contract manufacturer goes out of business or drops a product line and no other alternative is available,
- there are no opportunities for external contract manufacturer development,
- prices of manufacturing service realized by external contract manufacturer increase suddenly,
- acquisition of external contract manufacturer by a direct competitor has place,
- quality level of processes or goods realized by external contract manufacturer lowers suddenly (Gilmore 2017).

In-house manufacturing is used when product or component has critical importance for a company's effectiveness, when production process is vulnerable to time of deliveries (delays) or often design changes (problems with new designs or technology implementation). In such cases rigorous supervision over production and logistics is necessary. Enterprise should be sure about components' availability and their accordance to rigorous quality requirements. Obviously, benefit of establishing manufacturing capacity in-house is that the company can control an enabling capability for its business. While this is clearly an advantage, there are costs to obtain this control (White Paper 2017). Obviously, this cost may be much higher in situation when external contract manufacturer will be located in a distant country.

Another reason to insource is connected with vertical integration realized by members of a structure called a supply chain. The key issue of this structure is a partnership and strong cooperation between suppliers of raw materials or components, manufacturers and distributors. Organizational capital built by members of such a specific structure, allows gaining much better results than in case of typical buyer-seller relations. Well developed cooperation and integration of supply chains is one of the solutions which are necessary for risk reduction. Trust and reliability may be an irreplaceable advantage. Success of some manufacturing companies may be presented as an example. Japanese car producers are organized around greater supplier involvement in the process of new product development. They noticed very good results at the background of American car producers, which use very despot rules, which led to many conflicts with suppliers and cooperants, and finally brought many other negative effects (Liker and Choi 2007).

There is also another strong argument for partnership in case of in-house manufacturing. Long lasting and successful collaboration may be also realized in another field, namely between manufacturer and technology supplier. Such entity creates, develops and sells knowledge and technological solutions to manufacturers.

Such transactions must be supported by expertise and tacit knowledge, of technology supplier. Process of selling the technology is (because of its nature) complex and

sophisticated. In particular, significant attention has to be given to the importance of balancing the ability to meet current and future market opportunities. Manufacturers may have especially big difficulties with determining the intrinsic value of the technology they buy (Vinding 2004). When they choose a supplier of a tangible (simple) commodity (for example purchasing some basic goods like wooden or steel elements), it is easier for the manufacturer to verify the value of delivered goods. Technology suppliers can't just oversee the market in which there are many players, which use different strategies, but they must identify innovations and technologies able to give rise to new value propositions and new markets in the long run (Riviezzo 2013). The role of such a supplier can't be overestimated, especially in case of delivering new production line, which is connected with tacit and expertise knowledge. Good relations with such entities, their support during technology selection and implementation may be treated as one of the basic factors for in-house manufacturing. It reduces risk of selecting technology, which may quickly become obsolete.

4. The role of technology suppliers in transfer of new technology and knowledge to manufacturers

Manufacturers are facing a turbulent and dynamic environment characterized by rapid technological change, growing technological complexity and shortening product lifecycles (Riviezzo 2013). Because of that many manufacturers find it difficult to absorb effectively the proprietary value-creating technology delivered by the external supplier (in terms of lack of sufficient scientific or engineering knowledge background) (Park 2011). The typical reason is lower level of knowledge resources available within the production organization which buy new technology. New technology is usually difficult to learn and may have limited value because of lack of a common language for understanding know-how. Employees of manufacturing company (acquirer of a new technology) may not be oriented in the nuances of carried out researches, results achieved in some complex experiments realized in isolated laboratories (which finally led to work out the new technology). They also may have no direct contacts with scientific or research institutions, simply focusing on realization the actual production schedule, struggling with delays (for example in purchasing or logistics area), failures, damages and breakdowns in production area etc. People who work in strict time discipline may have no possibility to expand their knowledge base.

The other problem is connected with corporations' hierarchy often met in production organizations. When tacit knowledge is transferred to managers who are responsible for its further transfer to specialists, this formalized way is usually inefficient. Less formal way of knowledge transfer causes that data and knowledge will be "freer" than that communicated in a hierarchy, which is characterized by being more formalized (Vinding 2004). In such, very often met, situations there is a clear and significant role of technology supplier. It should possess relevant knowledge which increases the ability to understand and assimilate new data and skills by manufacturer's staff. It was recognized that what can be learned is directly associated with what is already known (Park 2011). For example, Inkpen (1998) argues that possession of relevant knowledge allows the effective use of new knowledge. Absorptive capacity framework of workers of technology supplier may significantly shed light on the

details of the delivered solution. According to Caloghirou et al. (2004), the enhancement of absorptive capacity based on the possession of relevant knowledge increase ability to search, recognize, as well as assimilate and use new knowledge. It can be a legitimate mechanism for transmitting embedded external knowledge and technology which is based on it (Hebert et al., 2005). According to Tsang (1999), distribution of machines and operational manuals alone to a subsidiary or a distant acquirer is not sufficient to ensure a successful technology acquisition. There are many examples of relations between manufacturer and knowledge organization which show that acquirers of new technology very often need additional external support in the field of new technology complete implementation (Vinding 2004). Participation of external experts, as a third party support, has been mentioned as a factor playing an essential role in the transfer of technological knowledge (Park 2011). This is because external experts often own the necessary experience and socially embedded skills that can be transferred to acquirer, through learning process or appropriate training programs (Bouquet et al., 2004). Thus, the involvement of external experts can be a key factor in improving and developing human capital in production organization which is acquiring new technology. Technologies have tacit characteristics, which reside in the people who operate the technologies. In this regard, transfer of knowledge or technologies from transferor to acquirer needs to be handled by experts who are familiar to the practices (Park 2011). The tacit and embedded nature of technological knowledge creates barriers to its efficient implementation in manufacturer which is acquiring new technology. For this reason, a variety of organizational mechanisms, including people-based, are required for manufacturers to successfully acquire such knowledge and for suppliers of technology to realized order of manufacturer in a correct way (Park 2011). Wang et al. (2001) suggest that personal interactions between knowledge transferors and acquirers is a prerequisite to promote technology acquisition in that the absorptive capacity of the subsidiary to learn external technology will depend on the ability of external managers to share their experiences and communicate their knowledge to employees in the organization acquiring new technology. The knowledge transfer from transferors (knowledge organization) to acquirers (for example manufacturer) occurs through active support from the firm possessing the knowledge (Inkpen 1998). This active support of transferor in technological management facilitates the sharing and communicating of advanced external skills and provides an opportunity to help in transforming tacit knowledge to explicit knowledge (Park 2011). Knowledge transfer concerns various forms of learning, the creation of a knowledge sharing climate, programme preparation, establishment of training units which assess and analyse training needs, provide and evaluate training (Svetlik and Stavrou-Costea, 2007). Park (2010) also emphasizes that the extent of knowledge acquisition is significantly affected by the knowledge transferor's level of contribution on various functions.

In order for newly incoming knowledge to be internalized for substantial knowledge acquisition, acquired data and information need to be collected and made available to workers of manufacturers which is going to buy new technology. Such a support from the transferor (e.g., assistance in technological management to transfer technological skills) is the principal foundation for improvement of knowledge acquisition capability (Park 2011).

5. Knowledge management in entities which supply technology to manufacturers

There are four main phases of KM, which should be noticed: knowledge acquisition, which focuses primarily on searching among various sources of data, information and knowledge, their selection, bringing the existing knowledge in the possession of relevant members of organization; the second phase involves knowledge creation, which focuses on the development and increasing bulk of new knowledge; the third phase entails knowledge utilisation and application; the fourth phase is knowledge transfer, distribution, dissemination and sharing, aiming for relevant knowledge to reach relevant individuals and groups within the structure of acquirer (Svetlik and Stavrou-Costea, 2007). Knowledge creation needs preparation a supportive environment, the provision of information feedback flows, requisite HRM system and other systems of encouragement like these which will be stimulating remuneration. Knowledge acquisition is about recruiting outstanding people and about helping them learn – it includes also investment in the training and development of human resources (Svetlik and Stavrou-Costea, 2007). It is also about encouraging employees to participate in professional networks and communities of practice that extend beyond organisational boundaries (Wenger et al., 2002). In some enterprises teams are created in order to be challenged by the organizational problems solving, just to get new skills.

On the base of mentioned arguments four hypotheses have been formulated:

H1 – Cooperation with external knowledge organizations in the field of new technology development is connected with cost reduction and higher possibilities.

H2 – Open discussions among employees of entities which deliver new technology to manufacturers is an important factor of knowledge management process.

H3 – Technology suppliers are open for informal contacts with external experts.

H4 – Process of intellectual capital building is realized in several different ways (there is no one predominant way).

A questionnaire was directed to over 300 companies which deliver new technological solutions to manufacturers. 54 answered to this survey. First question concerned the ways (in-house R&D activity or collaboration with external organizations) of creation the most innovative solutions. The answers show that:

- 24 entities (44.44%) were creating new solutions on their own,
- 11 entities (20.37%) answered that such solutions were created on the base of developed, collaborative network (together with universities and external R&D centres),
- 10 entities (18.52%) answered that most innovative solutions were worked out in cooperation with subsidiaries and dependent units,
- 5 entities (9.26%) answered that they were created in cooperation with business partners and cooperants,
- 4 entities (7.41%) answered that they were created in collaboration with other companies from the same sector (even with competitors).

Generally, over 55% (30 entities) of respondents create these most innovative solutions in collaboration, and over 44% create them individually (without external support). These 30 entities had been asked for reasons of using external support in the field of new solution creating;

- 12 entities (from a group of 30) answered that they did it because of lower costs of new technology development,
- 10 entities pointed out higher level of technological advancement of external companies,
- for 9 entities it was broad offer of proven and well-tried solutions,
- for 8 entities it was deeper knowledge of external unit in the field of newest solutions.

Next question was connected with internal openness for a discussion and importance of the discussion between specialists employed in the particular entity;

- 49 entities (90.74%) pointed out high openness during discussions. In their opinion these discussions were important or very important,
- in 5 entities (9.26%) attitude towards openness was of symbolic meaning – efficiency of KM procedures was in their opinion more important.

Next question was connected with evaluation of importance of informal relations with external experts in the field of innovation;

- 35 entities (66.67%) answered that they are important or very important,
- for 10 entities (18.52%) these relations had no meaning,
- 9 entities had problem with answering this question.

Above-mentioned 35 entities had been asked for motives of informal collaboration with external experts;

- for 23 entities informal collaboration with external experts was needed to avoid mistakes connected with new technology refining and implementation,
- in 18 entities – it helped to acquire knowledge about solutions which were being developed by competitors,
- in 17 entities – it helped to discover quite new areas of innovation,
- in 15 entities – it helped to get knowledge about technological innovations which may become leading solutions in the future,
- in 11 entities – it helped to define strategic directions of development of a particular entity,
- in 8 entities – it led to changes in a way of running business.

Next question concerned areas of knowledge management in analyzed entities;

- 39 entities (72.22%) answered that the key area of KM was internal skills development (investing in internal intellectual capital),
- for 34 entities (62.96%) it was connected with in-house involvement in R&D activity,
- for 26 entities (48.15%) it relied on acquiring new skilled and experienced specialists,
- for 24 entities (44.44%) it relied on sharing knowledge with customers,

- for 23 entities (42.59%) it meant cooperation with external R&D centres,
- for 19 entities (35.19%) it was connected with acquiring knowledge from external sources,
- for 17 entities (31.48%) it was based on knowledge transfer between subsidiaries of particular entity.

Next question concerned ways of recruiting skilled specialists;

- 43 entities (79.63%) were improving skills of own staff,
- 35 entities (64.81%) tried to recruit new skilled specialists putting job offers in papers, mass media or internet,
- 25 entities (46.30%) were offering traineeships for prospecting students,
- 19 entities (35.19%) were trying to outbid best specialists from other companies from the same sector,
- HRM agencies and “head hunters” were commissioned to recruit such specialists by 14 entities (25.92%).

Next question considered changes in a number of highly skilled specialists in analyzed entities. This number

- increased in 27 entities (50%),
- decreased in 3 entities (5.56%),
- was more or less on the same level in 24 entities (44.44%).

Last question concerned methods of building own intellectual capital:

- in 40 entities (74.07%) – there were external courses,
- in 39 entities (72.22%) – self-improvement, self education,
- in 37 entities (68.52%) – internal trainings realized by specialists from a particular entity,
- in 34 entities (62.96%) – training realized in the office space of a particular entity, but by external experts,
- in 18 entities (33.33%) – additional education activity (postgraduate studies or MBA courses).

6. Conclusions

These results show that most of entities were realizing KM practices in several ways. Building own intellectual capital was based on investing in skills of employees and looking for new skilled specialists (H4 has been confirmed). H1 also has been confirmed – cooperation with external entities in the field of new technology development was connected with cost reduction and higher possibilities offered by external knowledge organizations. External support was especially important when managers wanted to get access to deeper knowledge and more sophisticated know-how. Open discussions among employees of entities was an important factor of knowledge management activity (H2 has been confirmed). Informal contacts with external experts noticed in 66.6% of entities, was treated as a tool needed to

avoid some mistakes and to get knowledge about newest technologies, prospects of new ideas and competitors activity (H3 has been confirmed to a certain extent). This can be an interesting research area for further work.

References

- Aboutalebi R. (2017). The Taxonomy of International Manufacturing Strategies. In L.Brennan & A.Vecchi (Eds.), *International Manufacturing Strategy in a Time of Great Flux, Measuring Operations Performance*. Springer International Publishing Switzerland.
- Álvarez, I., Marin, R., & Fonfria, A. (2009). The role of networking in the competitiveness of firms, *Technological Forecasting & Social Change* (76), 410-421.
- Bouquet, C., Hebert, L., & Delios, A. (2004). Foreign expansion in service industries: separability and human capital intensity. *Journal of Business Research*, 57(1), 35-46.
- Brown, A. (2009). A Shift in Engineering Offshore. *Mechanical Engineering*, 131(3).
- Caloghirou, Y., Kastelli, I. & Tsakanikas, A. (2004). Internal capabilities and external knowledge sources: complements or substitutes for innovative performance?. *Technovation*, 24(1), 29-39.
- Cheng, I. (2004). Sourcing Goods from China: The Mass Migration. *The China Business Review*, Waszyngton, 31(5), 8-23.
- Gilmore B., (2017). *Make vs. Buy Network for Value Chain Excellence Training*. Published online: January 25, @:<https://wpcarey.asu.edu/sites/default/files/gilmoremakevsbuy.pdf>
- Hawkes H., & Schwarting D. (2011). *Make or buy. Three pillars of sound decision making*, PWC.
- Hebert, L., Very, P., & Beamish, P.W. (2005). Expatriation as a bridge over troubled water: a knowledge-based perspective applied to cross-border acquisitions, *Organization Studies*, 26(10), 1455-76.
- Inkpen, A.C., & Dinur, A. (1998). Knowledge management processes and international joint ventures. *Organization Science*, 9(4), 454-68.
- Liker, J.K., & Choi, T.Y. (2007). Keiretsu – prawdziwe partnerstwo z kooperantami. In *Zarządzanie tańcuchem dostaw*. Harvard Business Review, Wydawnictwo Helion, Gliwice.
- Młody, M. (2017). Dylemat *make or buy* – przesłanki wyboru międzynarodowej strategii produkcyjnej. *Handel Wewnętrzny*, 3(368), 288-299.
- Oblój, K. (2016). *Pasja i dyscyplina strategii. Jak z marzeń i decyzji zbudować sukces firmy*, Wydawnictwo Poltext, Warszawa.
- Park, B.I. (2010). What matters to managerial knowledge acquisition in international joint ventures? High knowledge acquirers versus low knowledge acquirers. *Asia Pacific Journal of Management*, Vol. 27 No. 1, pp. 55-79.
- Park, B.I. (2011). Differences in knowledge acquisition mechanisms between IJVs with Western vs Japanese parents: Focus on factors comprising absorptive capacity. *Management Decision*, 49 (3), 422-443.
- Peruta, M.R.D. (2017). *From the Dilemma of whether to "Make or Buy" to the Choice of "Internal or External Resource Sourcing"*. In M.R.D.Peruta (Eds.) *Building Markets for Knowledge Resources (Innovation, Technology, and Education for Growth)*. Published online: 13 Feb 2017; 37-46. @:<https://www.emeraldinsight.com/doi/abs/10.1108/978-1-78635-742-720161003>

Probert, D.R., Jones, S.W., & Gregory, M. J. (1993). The make or buy decision in the context of manufacturing strategy development. *Journal of Engineering Manufacture*, 207, 241-250.

Riviezzo, A. (2013). Acquisitions in knowledge-intensive industries: Exploring the distinctive characteristics of the effective acquirer. *Management Research Review*, 36(2), 183-212.

Svetlik, I., & Stavrou-Costea, E. (2007). Connecting human resources management and knowledge management. *International Journal of Manpower*, 28(3/4), 197-206.

Tsang, E.W.K. (2002). Acquiring knowledge by foreign partners from international joint ventures in a transition economy: learning-by-doing and learning myopia. *Strategic Management Journal*, 23(9), 835-54.

Vinding, A.L. (2004). Human resources; absorptive capacity and innovative performance. In J.L. Christensen & B.Å. Lundvall (Eds.), *Product innovation, interactive learning and economic performance*, Elsevier.

Wang, P., Singh, K., Koh, C.P., & Tong, W. (2001). Determinants and outcomes of knowledge transfer: a study of MNCs in China, *Paper presented at Academy of Management Conference*, Washington.

Wenger, E., McDermott, R.A., & Snyder, W. (2002). *Cultivating Communities of Practice: A Guide to Managing Knowledge*. Harvard Business School Press, Boston, MA.

White paper. (2017). *Four key elements of the make-or-buy decision*. Published online: @:www.vitex.com

Wilkinson J. (2013). *Make-or-Buy Business Decision*. Published online: July 24, 2013, @:https://strategiccco.com/make-or-buy-business-decision/

FDI Determinants of Firms Transferring Technology with Know-how as a Transfer Channel – Homogeneity of Areas and Barriers of Technology Transfers

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Abstract: Technology is increasing in importance as a factor of economic development. Given that Foreign Direct Investment is seen by researchers as a significant technology growth stimulating factor, the topic of FDI determinants is an important subject for study. Especially in case of economies classified as modest innovators that are at the best position to benefit from technology transferred with FDI. This study aims to establish the hierarchy of FDI determinants of firms that use know-how as a channel for technology transfer and to identify the barriers and areas of technology transfer, which are hypothesized to be homogeneous across the examined firms given the importance that they assign to the determinants of FDI. Primary data was collected among technology transferring FDI firms in Poland and a set of statistical tools ranging from standard descriptive statistics to factor and cluster analyses were used. European Union membership, the internet/telecommunication infrastructure and a vast set of determinants describing the intellectual labour force are the most important FDI determinants from the perspective of the foreign firms that transfer technology with the means of know-how. Administrative and legal are the key barriers of the studied transfers, which tend to concentrate in the manufacturing area.

Keywords: Foreign direct investment, technology transfer, know-how

1 Introduction

Transfer of technology is one of the indirect benefits of hosting Foreign Direct Investment (FDI), which is important not only due to the increasing role of technology as a factor of production as well as an increased focus of policymakers on innovation, but also because transferred technology is technology obtained cheaper in comparison to technology developed in-house. This is particularly important for economies classified as moderate and modest innovators – for details on this classification see the European Commission (2017) publication. Therefore, this research undertakes the challenge of identifying the key determinants of such investments as well as the areas and barriers of the said transfers.

Despite heterogeneity of results obtained by various researchers when studying the effects of FDI – as noted by e.g. Grattan (2011) or Iamsiraroj and Ulubaşoğlu (2016) and discussed (along

with possible source) by Napiórkowski (2017) – the consensus is that economies do benefit from hosting FDI. The said benefits can be differentiated between those that do not require significant participation on the side of the host economy (i.e., direct benefits of FDI) and those that require absorptive capacity (i.e., indirect benefits of FDI, see: Nunnenkamp 2004; Kim et al. 2015). The first group consists of higher wages (Tomohara and Takii 2011) and higher level of investment (Pilbeam and Oboleviciute 2012), while the second group is composed of technology transfers (Svedin and Stage 2016) and transfers of know-how (Temiz and Gökmen 2014) – the latter being understood as a specific set of applicable knowledge that cannot be obtained elsewhere at an equal or a lower cost.

Keeping in mind the rich set of benefits that inward FDI can bring to the hosting economy, the topic of the determinants of FDI is an important one. This topic increases in importance once it is combined with the idea of the earlier-mentioned indirect benefits of FDI, which (unlike their direct counterpart) do not simply move the host along the current production function path, but allow the said economy to jump curves, i.e. to shift to a higher development path.

Therefore, the study aims to answer two research questions. First, what is the hierarchy of Foreign Direct Investment determinants of firms that use know-how as a channel for technology transfer? Second, are the barriers and areas of technology transfer homogeneous across the examined firms given the importance they assign to the determinants of FDI?

To achieve the set-out goals, the study uses primary data collected among firms that have conducted FDI in Poland and have carried out a technology transfer to a Polish firm. To answer the first research question, descriptive statistics and frequency distributions were used. To answer the second research question, factor analysis followed by a cluster analysis and a set of ANOVA tests have been implemented.

The text first examines the relevant literature, in which it references such topics as the heterogeneity of determinants of FDI and the channels of technology transfer employed by foreign firms or the barrier they encounter. Next data and the collection process are described in more detail, which is followed by the empirical part of the study and the resulting summary of obtained results.

2 Literature review

The aim of this part of the paper is to present a literature-based discussion on the determinants of FDI as well as FDI spillovers – for the latter, including their channels and barriers.

2.1 Discussion of Foreign Direct Investment determinants

The topic of FDI determinants is very vast and includes a multitude of possible variables that aim to represent various economic concepts. This issue makes for a relatively poor cross-study homogeneity of used explanatory variables, which has been highlighted for example by Boligien and Piger (2011). In their study Blonigen and Piger (2011) use the Bayesian Model Averaging procedure to select the most likely determinants of FDI. As much the authors point

to gravity and proximity (e.g., cultural) as well as GDP related variables to have the highest inclusion probability, they find that such a staple determinant of FDI as trade openness have low probability of inclusion. Bayesian Model Averaging was also used by Eicher et al. (2011) who, having research aims similar to those of Blonigen and Piger (2011), point that robust FDI determinants can be grouped into two sets. One related to country characteristics (e.g., common language, lack of corruption), and second focused on economic aspects (e.g., level of development, financial risk). The authors also find that trade agreements are a significant factor determining FDI – also seen in Napiórkowski (2014).

Many authors have employed various classifications of FDI determinants. Some are discussed here. Navaretti and Vanables (2006) show that the determinants of FDI also depend on FDI's vertical or horizontal nature (Table 1). Przybylska (2001) offers another classification of FDI determinants as she groups them into six categories (Table 2). Geldner (1986), uses the following classification: costs of production (especially costs of labour force), marketing factors, trade factors, (especially any limits put on international production and service exchange) and host's political profile, agendas. Nunnenkamp (2002) concludes that the heterogeneity of FDI explanatory variables will depend on the level of development of potential hosts. Stawicka (2013) – working of Oziewicz (1998) – lists 10 key determinants of investments abroad that are subsequently collected into cost motives (generally associated with looking for a less expensive way of production, but also include diversification of the investment portfolio that, by definition, does not qualify as FDI), profit motives (searching for new markets, tariff jumping, financial arbitrage – the latter not counted as part of FDI) and mixed motives (motives associated with the processes of control and centralization as well as control over the foreign party). Walsh and Yu (2010) show that the significance of FDI determinants will also depend on the sector of FDI; i.e., primary, secondary and tertiary.

Table 1. Determinants of FDI according to their vertical/horizontal nature according to Navaretti and Vanables (2006)

Determinants	Prediction by type of investment	
	Horizontal	Vertical
Determinants relate to types of firms or industries		
Firm-level economies of scale	+	+
Plant-level economies of scale	-	?
Product-specific trade costs	+	-
Costs to disintegrate stages of production	-	-
Difference in factor intensity between stages of production <i>Determinants relate to types of countries</i>	?	+
Trade costs (distance, trade barriers, etc.)	+	-
Market size	+	?
Factor cost differentials	?	+

Table 2. Grouping of FDI determinants according to Przybylska (2001)

Determinants based on motives for FDI action	
1.	Market determinants <ul style="list-style-type: none"> a. Size and absorption of the market b. Potential for market evolvement c. Barriers to trade d. Access to regional markets
2.	Cost Determinants <ul style="list-style-type: none"> a. Access to natural resources b. Level of costs of production c. Labour costs d. Cost of access to capital e. Energy cost f. Taxes g. Access to advanced technologies, qualified labour forces and R&D facilities h. Geographical location
3.	Efficiency determinants <ul style="list-style-type: none"> a. Optimal combination of market and cost determinants b. High degree of concentration of economic activity in countries in a specific region c. Ability to cooperate with local enterprises
Determinants based on the investment climate in the host economy	
1.	Environment in which transnational corporations operate <ul style="list-style-type: none"> a. Economic and political stability b. Policy concerned with the liberalization of FDI (e.g., rules of domestic market access, treatment of foreign investors, ability to participate in privatization) c. Legal regulation of FDI d. Membership in international economic organizations
2.	Operational benefits given to transnational corporations <ul style="list-style-type: none"> a. Investment benefits b. Business environment (transportation and telecommunication infrastructure, administrative bottlenecks, banking system and capital market) c. Promotion of FDI
3.	Level of investment risk

The problem of FDI determinants is further multiplied by the fact that one economic concept (e.g., host's market) can be represented by many permutations of the same variables (e.g., GDP, GDP per capita, difference between host's and home's GDP).

This discussion of the topic of FDI determinants leads to a fact that determinants used ought to be specific to a current case study (e.g., Leitão 2010) and that it is next to impossible to declare one determinant not important in general (e.g., Stawicka 2013).

2.2 Discussion of Foreign Direct Investment spillovers, including channels and barriers

Blomström and Kokko (1988) say that "spillovers occur when local firms benefit from the MNC affiliate's superior knowledge of product or process technologies or markets, without incurring a cost that exhausts the whole gain from the improvement" (Blomström and Kokko 1988, p. 257). Crespo and Fontoura (2007) define FDI spillovers as "a concept that embodies

the fact that MNEs (multinational enterprises) own technology ... which can be transmitted to domestic firms and thereby raise their productivity level” (Crespo and Fontoura 2007, p. 410). The authors also offer a much more broader understanding by stating that “the spread of productivity spillovers is thus a matter of externalities being transmitted from established foreign producers to domestic ones” (Crespo and Fontoura 2007, p. 410). Salim et al. (2017) state that “technology spillover refers to the beneficial impacts of new technological knowledge on the productivity and technological capability of other firms or countries” (Salim et al. 2017, p. 209). Smeets (2008) defines “knowledge spillovers at the firm level as knowledge created by one firm (a multinational enterprise) that is used by a second firm (a host-country firm) for which the host-country firm does not (fully) compensate the multinational enterprise ... [therefore the proposed definition] does distinguish between knowledge spillover and knowledge transfer (the purposeful or intended diffusion of knowledge from one firm to the other, which creates no externality)” (Smeets 2008, p. 109). Another distinction is made by Newman et al. (2015), who define horizontal (intra-sector) spillovers as “those that result from knowledge and technology used by FDI firms transferred to competing firms in the same sector” and vertical spillovers (inter-sector) as “those that transfer through the supply chain from foreign intermediate suppliers to domestic producers or more commonly from foreign-invested firms to domestic input suppliers” (Newman et al. 2015, pp. 168-169).

At its most aggregate level, there are two channels of technology transfer; namely, trade and FDI (Kim et al. 2015, p. 2), which are further expanded on with contractual agreement (e.g., licensing) by Sinani and Meyer (2004). According to Crespo and Fontoura (2007), there are five channels through which spillovers can take place: “demonstration/imitation, labour mobility, exports, competition, and backward and forward linkages with domestic firms” (Crespo and Fontoura 2007, p. 411). This classification matches that of Salim et al. from 2017, i.e. “demonstration, training, collaboration, linkage and worker turnover” (Salim et al. 2017, 209), which itself is parallel to that of Liu (2008). Cooperation with other firms (a channel mentioned by, e.g., Lall and Narula 2004) can take two general forms; that is, backward and forward within the value chain. Newman (2015) states that the backward spillovers have the highest probability to occur if a domestic firm, which is a supplier to the foreign firm, receives productivity improvements. In terms of forward spillovers, they “occur when FDI into upstream sectors impacts on the productivity of downstream domestic firms ... [and] due to direct linkages or externalities and may be positive or negative” (Newman et al. 2015, p. 170). OECD (2002) shows that there is an additional classification of the relationships between firms that matters; namely (in addition to vertical), horizontal linkages that are categorized as cooperation (in case of complementary firms) or competition.

As stated earlier, spillovers are not achieved automatically. Nunnenkamp (2004) said that “the capability of local firms to absorb superior technology and knowledge appears to be a decisive determinant of whether or not the potential for spillovers will be realized” (Nunnenkamp 2004, p. 668). This “capability” can be hindered by many factors. The most often cited barrier in successful technology transfers is the technological gap between the home and the host economy (Glass and Saggi 1998; Blomström and Sjöholm 1999; OECD 2002; Lall and Narula 2004; Crespo and Fontoura 2007). Other determinants of the success of a technology transfer

include: regional effects, domestic firm characteristics (e.g., firm size), FDI characteristics (e.g., FDI entry mode, degree of foreign ownership) (Crespo and Fontoura 2007), stock of human capital (Keller 1996), productivity gap Liu et al. (2016), host innovative activities (Wang and Wu 2016) and the type of FDI – with favour given to acquisition than direct entry (Ghebrihiwet 2017).

The overview of channels of technology transfers allows to observe that knowledge is a significant element of the studied process. Adding to the importance of knowledge is the list of possible barriers that (behind macro elements) intertwine the role of human capital.

3 Data description and empirical analysis

This part of the text presents the empirics of the study; moving from data description, through the factor and cluster analysis (both conducted according to the standards described in Filed 2009; Mooi and Sarstedt 2011 accordingly) to the presentation of empirical results.

3.1 Data description

Primary data was collected among 302 FDI firms in Poland with the Computer Assisted Telephone Interview method from the population of 2,358 firms. The population set was obtained from the list of major foreign investors in Poland as published by the Polish Investment and Trade Agency (2017). This specification yields 5.27% margin of error at a 95% confidence level. From the drawn sample, 197 firms have indicated know-how as a channel for technology transfer; hence, serve as a sample for this study. Respondents were asked closed-ended, multiple-choice and either single- only or multiple-answer possible questions. Questions regarding the importance of FDI determinants were structured on a 5-point Likert scale; where 1 corresponded to “very unimportant”, followed by “unimportant”, “neutral”, “important” and “very important”.

The problem encountered when studying the determinants of FDI is their vast number, which often leads to their selection being case specific. Hence, the survey uses eight economic concepts, which all aggregate 26 economic variables representing the determinants of FDI (Figure 1). Based on the literature review, seven barriers to the technology transfer process were identified: lack of physical capital readiness (e.g., aged / old machinery), lack of human capital readiness (e.g., lack of qualification of the labour force), technological gap, administrative, legal and other. The last category was extended later to include two most common answers in this category; namely, financial barriers and existence of no barriers. Lastly, four possible areas of technology transfer were identified. First, transfer is connected with the manufacturing process (the product / service produced is known to the Polish consumer market and the transfer is connected with the change in the production process or introduces the production process to the Polish market, i.e. the product / service was never produced in Poland before). Second, transfer is connected with the product itself (the product is new to the Polish consumer market; therefore, it has never before been manufactured in Poland before). Third, transfer is connected with customer service after the sale. Fourth, transfer is connected with marketing initiatives. This selection was motivated by such papers

as Blomström and Kokko (1998), as the transferred technology can be “interpreted broadly to include both product, process, and distribution technology, as well as management and marketing skills” (Blomström and Kokko 1998, p. 247).

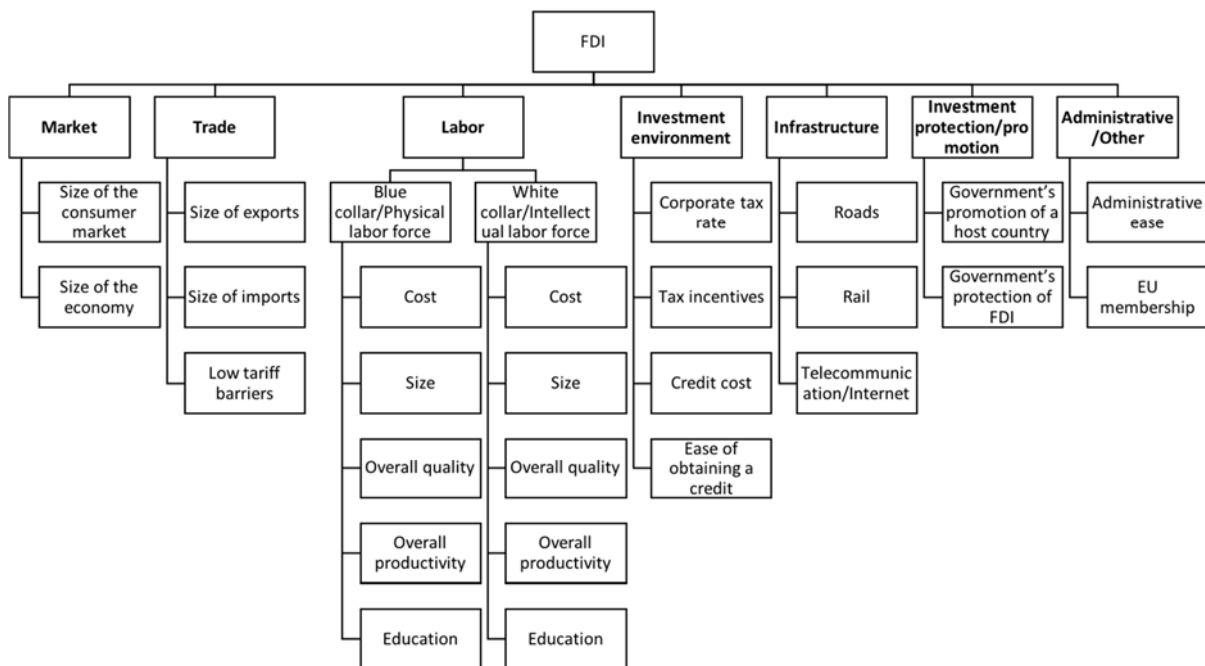


Figure 1. FDI determinants used for the questionnaire

3.2 Factor and cluster analyses procedure

Given the large number of FDI determinants (26), factor analysis was implemented to reduce the number of potential clustering variables. Principle component factor extraction method with the Eigenvalues cut-off point set to 1 was used. The Component Transformation Matrix, resulting from orthogonal rotation (varimax) with Anderson-Rubin factor scores, is not an identity matrix nor is it a mirror image over its diagonal. Therefore, an oblique rotation (direct oblimin) with regression as an option for factor scores is the preferred option. This has been confirmed with the fact that the resulting Component Correlation Matrix is not an identity matrix. The extracted factors (with 73.85% of total variance explained) chiefly correspond to the initial allocation of the determinants into eight groups (market, trade, blue collar/physical labour force, white collar/intellectual labour force, investment environment, infrastructure, investment protection/promotion and administrative/other) with some determinants (e.g., Polish imports) loading into more than one factor. The latter can be a result of the correlations between used variables – as suggested by the value of the determinant of the correlation matrix ($1.01e-7$). Despite the resulting factors can't be fully implemented, they serve as a general confirmation of an adequate grouping of FDI determinants within the survey.

Shifting to the cluster analysis, the value representing the importance of each group of FDI determinants has been calculated by taking an average of answers for group's individual members. The dendrogram resulting from the hierarchical clustering procedure with Ward

clustering method and Squared Euclidean distances provided a wide range of possible number of clusters, i.e. from 4 to 9. When each of the said cluster solutions was tested for stability with the k-means clustering method (with centroids from the first step serving as inputs), only the 4-cluster solution proved to be stable. The created clusters were used as factor variables for the ANOVA tests that followed with studied areas and barriers as test dependent variables.

3.3 Empirical results

The results of the conducted set of analyses show that Polish membership in the EU is the most important determinant of FDI (score equal to 4.43), followed by the telecommunication and internet elements of the Polish infrastructure (4.29). The next spots are taken by descriptives of white collar/intellectual labour force (overall quality – 4.24, productivity – 4.19, labour cost – 4.16, size of the labour force – 4.13 and education – 4.11). Adding to this set the size of the Polish market (4.08) creates a list of the most important determinants of FDI for firms that use know-how as a channel for technology transfer.

Table 3. Relative importance of Foreign Direct Investment determinants

Foreign Direct Investment determinant	Mean score
Poland's membership in the European Union	4.43
Infrastructure - Telecommunication/Internet	4.29
Overall quality of the intellectual labour force in Poland	4.24
Productivity of intellectual labour force in Poland	4.19
Cost of intellectual labour in Poland (i.e., average monthly cost)	4.16
Size of intellectual labour force in Poland	4.13
Education of intellectual labour force in Poland	4.11
Size of the Polish consumer market (i.e. GDP per capita)	4.08
Cost of physical labour in Poland (i.e., monthly cost)	3.99
Overall quality of physical labour force in Poland	3.9
Size of physical labour force in Poland	3.89
Corporate tax rate	3.82
Administrative ease	3.82
Productivity of physical labour force in Poland	3.78
Infrastructure - Roads	3.74
Size of the Polish economy (i.e. GDP)	3.69
Low trade tariffs	3.49
Polish government's protection of foreign investments in Poland	3.21
Size of the Polish import	3.2
Size of the Polish export	3.15
The ease with which your company can borrow money in Poland	3.15
Education of physical labour force in Poland	3.08
Tax incentives	3.06
Polish government's promotion of Poland as a host country	3.06
Interest rate at which your company can borrow money in Poland	3.03
Infrastructure - Rail	3.02

The two barriers of technology transfer that stand out are administrative (indicated by 48% of surveyed firms) and legal (35%). Next are lack of human (16%) and physical (12%) capital readiness. Very interestingly, given the channel used to transfer technology by the surveyed firms and its prominent position as a barrier within the literature, the technology gap was indicated by only 4% – same for financial barriers. Only 13% of firms declared no barriers.

Table 4. Technology transfer barriers

Technology transfer barrier	Importance
Administrative	48%
Legal	35%
Lack of human capital readiness (e.g., lack of qualification of the labour force)	16%
No barriers	13%
Lack of physical capital readiness (e.g., aged / old machinery)	12%
Technological gap	4%
Financial	4%
Other	0%

Source: Author's own table based on results obtained with SPSS software.

The manufacturing process and the product itself were, the most common areas of technology transfers (64% and 52% accordingly). With customer service and marketing activities ranking significantly lower (15% and 14%).

Table 5. Areas of technology transfers

Technology transfer area	Importance
Transfer is connected with the manufacturing process	64%
Transfer is connected with the product itself	52%
Transfer is connected with customer service after the sale	15%
Transfer is connected with marketing initiatives	14%

A set of ANOVA tests (preceded with Levene's test for homogeneity of variance and supplemented with Welch Robust Tests of Equality of Means when needed) showed that (at a 5% level of statistical significance) there is no statistically significant difference in both, the barriers (Table 6) and areas of technology transfers (Table 7). Therefore, the previously mentioned observations on the barriers and areas of studied transfers do not differ with the importance of the determinants of FDI.

Table 6. ANOVA test for technology transfer barriers

	Levene Sig.	ANOVA Sig.	Welch Sig.
Lack of physical capital readiness (e.g., aged / old machinery)	.133	.788	.
Lack of human capital readiness (e.g., lack of qualification of the labour force)	.000	.211	.214
Technological gap	.331	.843	.
Administrative	.000	.089	.057
Legal	.329	.807	.826
No barriers	.166	.605	.808
Financial	.036	.461	.863
Robust tests of equality of means cannot be performed for Lack of physical capital readiness (e.g., aged / old machinery) because at least one group has 0 variance.			
Robust tests of equality of means cannot be performed for Technological gap because at least one group has 0 variance.			

Table 7. ANOVA test for technology transfer area

	Levene Sig.	ANOVA Sig.	Welch Sig.
Transfer is connected with the manufacturing process	.008	.078	.123
Transfer is connected with the product itself	.019	.113	.142
Transfer is connected with customer service after the sale	.000	.005	.064
Transfer is connected with marketing initiatives	.127	.595	.765

4 Summary of the obtained results

The findings show that human capital is a chief prerequisite for a successful technology transfer. Combining this conclusion with the fact that lack of physical capital is also found to be an obstacle, the study empirically confirms the importance of absorptive capacity as a chief determinant of indirect benefits of hosting Foreign Direct Investment. This falls in line with what has been shown by, e.g., Borensztein et al. (1998), Nunnenkamp (2004), Blomström and Kokko (2003), Azam and Ahmed (2015).

It is very interesting that the barrier to a successful technology transfer most often listed in the examined literature, i.e. technological gap, is a minor hindrance to foreign firms operating in Poland. Therefore, as an area of further study it would be interesting to re-examine this relationship for economies homogenous to Poland in a hope of finding a pattern.

5 Conclusions

The aim of this study was to identify the hierarchy of FDI determinants of firms that use know-how as a channel for technology transfer and to inspect if the barriers and areas of technology transfer are homogeneous across the examined firms given the importance they assign to the determinants of FDI.

To achieve the set goals primary data has been collected among FDI firms in Poland, which have declared to have conducted a technology transfer with the use of know-how as a transfer channel. Data was subsequently analysed with the use of descriptive statistics, principal component analysis, cluster analysis and a set of ANOVA test.

The results show that there is a clear order of importance that examined firms assign to each of the 26 tested FDI determinants with the top ones being related to Poland's EU membership, its telecommunication and internet infrastructure and its white collar / intellectual labour force. Based on the results of the statistical analysis, there is no indication that barriers and areas of technology transfers are heterogeneous across the groups of studied firms – where the firms were clustered according to their declared importance of individual FDI determinants.

Limitations of this study come from the primary data collection process. First, there is a responders' bias that could arise from the misunderstanding of the questions and possible answers. To minimize this bias, key elements were additionally defined. Also, two parallel surveys were prepared; that is, one in Polish and one in English, which allowed each respondent to select the language of the document, with which she/he felt the most comfortable with. All best attempts were implemented to avoid the "lost in translation" bias. Second, there is a probability that provided possible answers did not cover the entire spectrum of actual answers. To account for such a possibility, option "Other" was added. However, in cases of technology transfer channels and barriers, frequency of such selections is 0%. When looking at these limitations, it is important to keep in mind that technology transfer is a very hard to measure phenomenon (Keller 2009); therefore, there were no perfect substitutes to the employed method.

Having provided answers to the research questions set in this study based on a developing economy, it would be interesting to see if these findings hold for other developing economies in the region and how do (if) they differ among the group of developed host countries.

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References

- Azam, M., & Ahmed, A.M. (2015). Role of Human Capital and Foreign Direct Investment in Promoting Economic Growth. *International Journal of Social Economics*, 42(2), 98-111.
- Blomström, M., & Kokko, A. (1998). Multinational Corporations and Spillovers. *Journal of Economic Surveys*, 12(2), 247-277.

- Blomström, M., & Kokko, A. (2003). *The Economics of Foreign Direct Investment Incentives. National Bureau of Economic Research Working Paper, 9489.*
- Blomström, M., & Sjöholm, F. (1999). Technology Transfer and Spillovers: Does Local participation with Multinationals Matter? *European Economic Review, 43*(4-6), 915-923.
- Blonigen, B.A., & Piger, J. (2011). Determinants of Foreign Direct Investment. *NBER Working Paper, 16704.*
- Borensztein, E., De Gregorio, J., & Lee, J.-W. (1998). How Does Foreign Direct Investment Affect Economic Growth. *Journal of International Economics, 45*(1), 115-135.
- Crespo, N., & Fontoura, M.P. (2007). Determinant factors of FDI Spillovers – What Do We Really Know? *World Development, 35*(3), 410-425.
- Eicher, T.S., Helfman, L., & Lenkoski, A. (2011). Robust FDI Determinants: Bayesian Model Averaging in the Presence of Selection Bias. *Journal of Macroeconomics 34*(3), 637-651.
- European Commission. (2017). European Innovation Scoreboard 2017.
- Field, A. (2009). *Discovering statistics using SPSS.* SAGE Publications Ltd.
- Geldner, M. (1986). Przyczynek do teorii zagranicznych inwestycji bezpośrednich. *Monografie i opracowania, 193.* Warsaw: Wydawnictwo Uczelniane Szkoły Głównej Planowania i Statystyki.
- Ghebrihiwet, N. (2017). Acquisition or Direct Entry, Technology Transfer, and FDI Policy Liberalization. *International Review of Economics and Finance, 51,* 455-469.
- Glass, A.J., & Saggi, K. (1998). International Technology Transfer and the Technology Gap. *Journal of Development Economics, 55*(2), 369-398.
- Iamsiraroj S., & Ulubaşoğlu M.A. (2016). Foreign Direct Investment and Economic Growth: A Real Relationship or Wishful Thinking? *Economic Modelling, 51,* 200-213.
- Keller, W. (1996). Absorptive Capacity: On the Creation and Acquisition of Technology in Development. *Journal of Development Economics, 49*(1), 199-227.
- Keller, W. (2009). International Trade, Foreign Direct Investment, and Technology Spillovers. *National Bureau of Economic Research Working Paper, 15442.*
- Kim, H-H, Lee, H., & Lee, J. (2015). Technology Diffusion and Host-country Productivity in South-South FDI Flows. *Japan and the World Economy, 33,* 1-10.
- Lall, S., & Narula, R. (2004). Foreign Direct Investment and its Role In Economic Development: Do We Need a New Agenda? *The European Journal of Development Research, 16*(3), 447-464.
- Leitão, N.C. (2010). Foreign Direct Investment: The Canadian Experience. *International Journal of Economics and Finance, 2*(4), 82-88.
- Liu, W.S., Agbola, F.W., & Dzator, J.A. (2016). The Impact of FDI Spillovers Effects on Total factor Productivity in the Chinese Electronic Industry: a Panel Data Analysis. *Journal of the Asia Pacific Economy, 21*(2), 217-234.
- Liu, Z. (2008). Foreign Direct Investment and Technology Spillovers: Theory and Evidence. *Journal of Development Economics, 85*(1-2), 176-193.
- Mooi, E., & Sarstedt, M. (2011). *A Concise Guide to Market Research. The Process, Data, and Methods Using IBM SPSS Statistics.* Berlin Heidelberg: Springer-Verlag.
- McGrattan E.R. (2011). Transition to FDI Openness: Reconciling Theory and Evidence. *National Bureau of Economic Research, Cambridge, Working Paper, 16774.*
- Napiórkowski, T.M. (2014). The Impact of Poland's Accession to the European Union on the Country's Foreign

Direct Investment. In: M.A. Weresa (Ed.), *Poland Competitiveness Report 2014. A decade in the European Union* (pp. 113-133). Warsaw: Warsaw School of Economics Press.

Napiórkowski, T.M. (2017). The Role of Foreign Direct Investment in Economic Growth. The Production Function Perspective. *OPTIMUM. Studia Ekonomiczne*, 5(89), 221-236.

Navaretti, G.B., & Venables, A.J. (2006). *Multinational Firms in the World Economy*. Princeton: Princeton University Press, Princeton and Oxford.

Newam, C., Rand, J., Talbot, T., & Trap, F. (2015). Technology transfers, foreign investment and productivity spillovers. *European Economic Review*, 76, 168-187.

Nunnenkamp, P. (2002). Determinants of FDI in Developing Countries: Has Globalization Changed the Rules of the Game? *Kiel Institute of World Economics, Kiel Working Paper*, 1122.

Nunnenkamp, P. (2004). To What Extent Can Foreign Direct Investment Help Achieve International Development Goals? *The World Economy*, 27(5), 657-677.

OECD. (2002). *Foreign Direct Investment for Development. Maximizing Benefits, Minimizing Costs*. Paris: OECD Publishing Service.

Oziewicz, E. (1998). *Zagraniczne inwestycje bezpośrednie w rozwoju gospodarczym krajów Azji południowo-wschodniej (ASEAN)*. Gdańsk: Wydawnictwo Uniwersytetu Gdańskiego.

Pilbeam K., & Oboleviciute N. (2012). Does Foreign Direct Investment Crowd in or Crowd out Domestic Investment? Evidence from the European Union. *The Journal of Economic Asymmetries*, 9(1), 89-104.

Polish Investment and Trade Agency. (2017). List of Major Foreign Investors in Poland - December 2015.

Przybylska, K. (2001). Determinanty zagranicznych inwestycji bezpośrednich w teorii ekonomiczne. Empiryczna weryfikacja czynników lokalizacji zagranicznych inwestycji bezpośrednich w Czechach, Polsce i na Węgrzech. *Akademia Ekonomiczna w Krakowie, Zeszyty Naukowe Seia Specjalna: Monografie*, 144.

Salim, A., Razavi, M.R., & Afshari-Mofrad, M. (2017). Foreign Direct Investment and Technology Spillover in Iran: The Role of Technological Capabilities of Subsidiaries. *Technological Forecasting and Social Change*, 122, 207-214.

Sinani, E., & Meyer, K.E. (2004). Spillovers of Technology Transfer from FDI: The Case of Estonia. *Journal of Comparative Economics*, 32(3), 445-466.

Smeets, R. (2008). Collecting the Pieces of the FDI Knowledge Spillovers Puzzle. *World Bank Research Observer*, 23(2), 107-138.

Stawicka, M.K. (2013). Czynniki warunkujące wybór miejsca lokowania bezpośrednich inwestycji zagranicznych w Unii Europejskiej – studium komparatystyczne lat 2005 i 2011. *Zarządzanie i Finanse*, 11(1, Part 2), 315-329.

Svedin, D., & Stage, J. (2016). Impact of Foreign Direct Investment on Efficiency in Swedish Manufacturing. *Springerplus*, 5, 1-17.

Temiz D., & Gökmen A. (2014). FDI Inflow as an International Business Operation by MNCs and Economic Growth: An Empirical Study on Turkey. *International Business Review*, 23(1), 145-154.

Tomohara, A., & Takii, S. (2011). Does Globalization Benefit Developing Countries? Effects of FDI on Local Wages. *Journal of Policy Modeling*, 33(3), 511-521.

Walsh, J.P., & Yu, J. (2010). Determinants of Foreign Direct Investment: A Sectoral and Institutional Approach. *IMF Working Paper WP/10/187*.

Wang, C.C., & Wu, A. (2016). Geographical FDI Knowledge Spillover and Innovation of Indigenous Firms in China. *International Business Review*, 25(4), 895-906.

Different Leadership Styles in Organizations that adopt and do not adopt the BSC

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Abstract: The current macroeconomic context, recognized by its global, turbulent and competitive environment, pushes organizations, especially those that are most exposed to international markets, to have the capacity to achieve sustained performance. Given this requirement, managers are aware of its relevance and seek to implement effective tools to be able to evaluate organizational performance. Managers are aware of the need for sustained performance, as it characterizes a special effort for organizations because it compromises their continuity in the market; so it is considered a main focus in the organizational management area. Linked to this relevance, it is customary for managers to go beyond measuring tangible assets, as intangible assets play a key role for organizations and their competitive performance. Bearing this in mind, namely the importance of intangible assets, leadership style is crucial since it has the ability to promote and encourage the way collaborators behave, decide and guide organizational success. Indeed, leadership can drive and enforce the most powerful assets, which can be monitored by very specific management tools. The literature considers the Balanced Scorecard (BSC) as one of the most acknowledged well known management tools, as being able to define organizational strategy, such as supporting the communication strategy throughout all the organizational processes. In addition, based on its four perspectives the BSC goes beyond the traditional management systems, being able to monitor performance, promote strategic alignment and foster organizational communication. These features characterize the BSC as one of the most relevant strategic management tools to improve organizational performance. Regarding performance, the literature has found that the way leaders behave, manage tasks and also coordinate their collaborators has high impact. In this sense, the OCAI model is a powerful culture assessment instrument to investigate the leadership style among organizations with and without the BSC. To the best of my knowledge, there have been no studies aimed at understanding if the management style differs between these organizations. Considering that the BSC still has the potential to continue to raise its implementation rates, we consider it relevant to highlight the leadership differences, so that organizations which intend to implement the BSC may be aware of these existing differences. Based on this gap in the literature, the main objective of this research is to identify the leadership profile of the largest Portuguese exporters without the BSC and with the BSC. Furthermore, this quantitative study, based on questionnaires, seeks to identify differences between the leadership style of these organizations that adopt and those that do not adopt the BSC. With this knowledge in hand, the successful implementation rate of the BSC could be improved as the leadership has a crucial role. The empirical evidence from 107 out of 250 questionnaires reveals that there are

differences in the leadership style of the managers. Considering these outstanding empirical differences which are of high theoretical and practical interest, due to the implications of leadership towards performance, this investigation brings new light into this management field. As the adoption of the management tool BSC is still in the process of growth, we consider that further studies need to be conducted to research and understand the leadership differences in other types of organizations, such as those in other national cultural contexts.

Keywords: Balanced Scorecard, Organizational Culture, Leadership Style

1 Introduction

Organizational management faces a scenario of constant turbulence and change, which provokes a more competitive and dynamic attitude on the part of managers. Sustained in this dynamism, organizational culture is recognized as a complex phenomenon, which has an important influence in the daily life of organizations, especially in organizations inserted in turbulent and competitive environments, where change is a constant (Barney, 1986). To cope with these changes, organizational culture, according to Barney (1986), consists of a complex set of values, beliefs, assumptions and symbols that define how the organization monitors its business. multiple investigations (Ouchi, 1980; Smircich, 1983). In this sense, it is very important that organizations are able to adapt management strategies to deal with external pressures and constant changes in the environment (Smircich, 1983).

Bearing in mind the relevance of leader's role that has been increasingly emphasized because they are given an active and crucial role towards the organization's success (Cameron & Quinn, 2005; Shim, Lusch, & O' Brien, 2002). Given these daily challenges, managers see the need to be the most efficient, anticipating problems, their causes and possible solutions (Cameron & Quinn, 1999).

Accordingly to this requirement, managers feel the need to have management indicators, which do not focus only on financial indicators, so that they can have a broader and more effective view of their organization. Given that this range of indicators is central to and decisive for the success of organizations, the indicators should be interlinked and integrated into a single management tool. In addition, the interconnection will make it possible to align the indicators of the different perspectives, to characterize the strategy and to convey strategic information Kaplan & Norton, 1993, 1996a, 2001a; Mooraj et al., 1999; Wong-On-Wing, Guo, Li, & Yang, 2007).

Research Justification

Several studies also point out that employee motivation and the efficiency of group work play a very important role in organizational values (Shahzad, 2012). Acknowledging this importance Osório (2009) investigated the role of organizational culture in human resources management practices, considering that organizational culture shapes human resources and consequently is reflected in organizational performance. Thus, we intend to understand the

importance attributed to the style of leadership in organizations without the BSC and with the BSC, for which the following research question is considered:

Research Question: *To what extent does the leadership profile differ in organizations with without the BSC?*

In order to answer the research question, the following specific objective was defined:

Confirm if there are different characteristics in the type of organizational culture of the largest exporters without the BSC and the BSC;

For this purpose, the following operational hypotheses will be statistically confirmed:

Hyp1. A: *The mentor leader style differs in organizations with and without BSC*

Hyp1. B: *Entrepreneurial leader style differs in organizations with and without BSC*

Hyp1. C: *Coordinator leader style differs in organizations with and without BSC*

Hyp1. D: *Executive leader style differs in organizations with and without BSC*

2 Organizational culture and leader style

Organizational culture resides primarily in Sociology, but it is recognized that the particularity of each organization has high impact in organizational performance management (Gallagher, Brown, & Brown, 2008). Rohit, Fredericke Webster (1989) define organizational culture as the pattern of shared values and beliefs that enables one to understand how the organization guides its business. Consequently, organizational culture impacts on how people define their personal and professional goals (Lok & Crawford, 2004). In this sense, the way in which employees think consciously and unconsciously, the way they behave, react and understand reality has a reflection on organizational culture (Schein, 1996; Lok & Crawford, 2004).

Indeed, organizational culture has many extensions to explore, since it is influenced by the economic and social environment. Harris and Ogbonna (2002) consider it as one of the most fascinating and evasive topics for management researchers.

Organizational change may occur during complex processes, such as internationalization processes, mergers, inheritance acquisitions, among others (Barreto et al., 2013). In this sense, the way individuals plan their tasks, work towards their goals, face and solve obstacles reflects and characterizes the organizational culture (Heizmann & Lavarda, 2011).

On the one hand, although several researchers and managers have emphasized the importance of organizational culture, there is still no clear definition of the concept as referred by O'Reilly and Chatman (1996) and DiMaggio (1997), consequently meanings are given in accordance to a given group at a specific time (Pettigrew, 1979).

On the other hand, in a general view, organizational culture consists of collective thinking, which distinguishes members of different groups (Hofstede, 1980), corresponds to ways of dealing effectively with experience and is evidenced through employee behaviors (Brown,

1998). In this sense, Tichy (1982) points out that organizational culture interconnects a given organization.

Quinn and Rohrbaugh (1981) investigate the differences in the values that determine the various organizational effectiveness models, having defined four cultural typologies, namely the Clan type of culture (leaders who tend to take a participatory stance, offering interaction, trust and loyalty), the Adhocracy culture type (change and flexibility, motivation factors include growth, stimulation, diversification and creativity in the task), the market culture type (leading, competitive, severe and demanding leaders, focused on productivity) and finally the hierarchy culture type (stability posts, reflects values and norms associated with bureaucracy). Organizational values tend towards a particular cultural style that leads to the competitive behavior of an organization. Through this model of Quinn and Rohrbaugh it is possible to understand the relationship between leadership and culture. Leadership traditionally resides in the identification of personal qualities and characteristics that allow the distinction of leaders from non-leaders. The leader profile is distinctive as it reveals characteristics such as integrity, self-confidence and honesty (Barreto et al., 2013). However, leadership is a highly complex phenomenon that encompasses a link between the leader and the social and organizational systems in which they operate. In this sense, Trice and Beyer (1991) have already investigated the different roles played by leaders in a change of organizational culture, having ascertained that the main challenges of the leader lie in integrating and strengthening the organizational culture. Leaders effectively assume a crucial role in organizational culture, given that the way they react either to problems or to reward situations reflects organizational culture.

3 Leader style

Culture enables the understanding of organizational phenomena related to contemporary management, focused on competitiveness between companies and the emergence of innovative processes, such as organizational change. The need for organizational change is frequent in internationalization processes, mergers, acquisitions and successions, among other complex processes (Barreto et al., 2013). Given the need for change, the degree of job satisfaction, namely the positive emotional state, is relevant as referred by Suma and Lesha (2013) although it is recognized that one of the most relevant factors for employee satisfaction is characterized by financial compensation (Suma & Lesha, 2013). In situations that require organizational changes, which imply an adaptation of the organizational culture, the way in which individuals plan their tasks, face and solve obstacles reflects and characterizes the organizational culture (Heizmann & Lavarda, 2011). Thus, based on how they plan and execute, organizations can be characterized based on cultural traits or dimensions (Cameron & Quinn, 1999). Despite the differentiating characteristics among organizations, managers are forced to be as efficient as possible in order to avoid mistakes and their consequences (Cameron & Quinn, 1999) because of intrinsic competition and the macroeconomic environment. The relevance of the role of leaders is, today, a crucial one for organizational success (Cameron & Quinn, 2005; Shim et al., 2002). Considering the importance of the leadership role referred to by Cameron and Quinn (1999) and Whetten and Cameron (2005)

based on previous studies, these authors have identified common characteristics of leadership competencies that characterize management effectiveness. In this sense, Cameron and Quinn (1999) present the most relevant characteristics related to the four types of organizational culture.

The Hierarchy leadership style corresponds to a purely formal and structured environment, and good leaders are valued for their ability to control, coordinate, organize, and provide guidance (Cameron & Quinn, 1999).

In turn, the leader characterized by the Market Culture type, is one that is capable of managing competitiveness, fostering employees' energy and managing the delivery of services. In this context, the leader of this type of culture promotes decision and production (Quinn, 1984). In market-type organizations, the most effective leaders are characterized by high dedication to work with a focus on results, and a high ability to negotiate and motivate (Cameron & Quinn, 1999). Cameron and Quinn (1999) identify the Adhocracy type of culture as one featuring leaders who are less compliant of rules, whereas Hierarchy-type leaders emphasize and value the rules. There is also a difference between the Clan Culture type leaders, who support and have a close-knit way of managing, and the market culture type leaders, who assume an imperative and demanding position. They are considered to be competitive, consistent and demanding; they are even seen as executives and technicians, maintaining their focus on results (Cameron, 1985; Cameron & Quinn, 1999).

The Clan Culture type leader is recognized for the ability to manage teams, for interpersonal relationships, as well as for the development of colleagues. In this type of organization the leader corresponds to a participatory mentor and facilitator (Whetten e Cameron, 2005) or an organizational figure style that resembles the paternal figure (Quinn, 1984). Thus, in a summary form, the most effective leaders assume parental figures, being mentors and dedicated to building teams (Cameron & Quinn, 1999). Thus, it can be seen that managers of organizations characterized by the Clan Culture type usually have a prudent, discreet way of managing, with great care being given to ensure training and integration, so that their parental character may even stand out. Managers of this type of organization are usually seen as mentors and provide a pleasant work environment, based on knowledge sharing, as if it were a family.

Keeping in mind that leadership has an impact on job satisfaction, it also has its consequences in organizational effectiveness and economic success (Finkelstein, 1990). Denison, Hooijberge e Quinn, (1995) point out that more effective leaders develop capacities to succeed in each of the quadrants of the Cameron e Freeman matrix (1991). Each leadership style requires a condition of minimum conflict and maximum effectiveness, so that a congruent culture reflects, in turn, the leadership style of the organization itself. Organizations develop a dominant culture over time, which is adapted and shaped according to environmental challenges and changes (Sathe, 1983). The same happens with individuals who also face threats, uncertainties that sometimes lead them to shape their behavior (Daft & Weick, 1984).

To summarize, regarding leadership, distinctions about the type of leadership are notorious, according to the type of culture that characterizes the organization.

4 Balanced Scorecard

Nowadays managers have to define their goal/objective, what's expected, why, what's going to be measured, based on what and how (Drucker, 1954). The literature recognizes, since years, that the orientation only in financial indicators, and a short term view, compromises long term options (Porter, 1992). In order to avoid these limitations and facing the need to include financial and non-financial indicators, on the medium and long term analysis, the BSC was generated and implemented as an innovative management tool (Kaplan & Norton, 1992). It's one of the most iconic management tools to monitor and balance organizational performance indicators, bearing in mind, that Kaplan and Norton (1992; 1996) referred that organizational management can not focus only on financial indicators, as the financial side, on itself, doesn't generate value. BSC is a multidimensional management tool that aggregates four fundamental organizational management perspectives, such as: financial, internal, customer and innovation and learning perspective (later denominated as learning and growth). The financial perspective consists in financial measures, such as incomes and productivity, with reflection of economic and financial decision done in the past (Kaplan & Norton, 1996). The customer perspective features the market segmentation, such as the value creation, in order to satisfy and build customer's loyalty and to obtain better financial returns (García-Valderrama, Mulero-Mendigorri, & Revuelta-Bordoy, 2008). Referring to the internal perspective that focuses on identification and analysis of critical processes of value creation, related to productivity and efficiency, both in short and long term (Kaplan & Norton, 1992). Lastly, the learning and growth perspective focuses on indicators related to employees' performance, towards organization's growth.

As mentioned, the primary goal of the BSC, composed by its four perspectives, until mid-90's, was to measure organizational performance. Posteriorly, based on the four perspectives, it covered also the growth forecast, research and product development, as well as human resource integration (Kaplan & Norton, 1996). These four perspectives are generally composed by 18 to 25 indicators that enable the comparison, between the defined targets and the actual status, beside the individual analysis also in an aggregated and interlinked way (Kaplan & Norton, 1996, 2000, 2001a, 2001b).

5 Methodology

The methodology consists in detailing all the steps to achieve a specific research objective. This can be described as an integrated set of norms and procedures that guide scientific research (Lessard-Hébert, Goyette, & Boutin, 2010). Thus, the methodology consists of the procedures that the researcher defines in order to arrive at the reality of the investigation, that is, the verification of its initial questions (Guba & Lincoln, 1994). The epistemological positioning that moves this research resides in the positivist paradigm because it investigates an apprehensible reality (ontology) that in this investigation corresponds to the identification of different leader styles in organizations with and without the BSC. Therefore, the methods of this research correspond to quantitative methods, which aim to test and prove the theory, explicitly, based on a set of investigation hypotheses.

Due to this innovative theme, a quantitative, hypothetical-deductive study of positivist positioning was developed. As the literature mentions that the BSC is a management tool that is implemented mainly in larger organizations, this study was developed on hand of the 250 largest exporters in Portugal. After the definition of the sample, the questionnaire was developed, supported by the literature and based on the information collected through interviews with four senior managers, in order to obtain feedback on the questions posed, since they have more experience and knowledge of their organizations (Macmillan, Farh, & Chen, 1993).

Procedures of data collection

The sample is composed of 107 organizations out of the 250 largest exporters in Portugal, with a response rate of 43%. In relation to the time span for the answers this comprised the period between 07.12.2016 and 03.02.2017.

6 Data analysis

All questionnaires and their variables were coded carefully and organized into the database to allow statistical treatment in IBM® SPSS®. For the preparation of the statistical analysis a data test was performed through the Normal Distribution Confirmation. Accordingly, we started the statistical verification based on the confirmation of the normality of the distribution. For this purpose we selected the Kolmogorov-Smirnov test that is intended to study if a sample can be classified as coming from a normal population, having verified that most of the variables under analysis do not follow a normal distribution. As the type of leadership supported by Cameron (1985) was investigated in this research, we started with the first analysis.

Hyp1. A: The mentor leader style differs in organizations with and without BSC

Regarding the mentor leader style, to test the hypothesis under study, the Mann-Whitney test was performed for independent samples (Table 1).

Table 1: Mentor Leader

Variable	Without BSC			With BSC			Test applied	Z value	Sig.
	Average	STD deviation	STD sample error	Average	Sample Deviation	STD average errors			
Hyp1. A: Mentor Leader	2,15	1,142	0,167	2,17	0,941	0,157	U Mann-Whitney	-0,647	0,518

Source: self-elaboration

Based on the results obtained in the Mann-Whitney U test ($p\text{-value} = 0.518 > 0.05$), it is concluded that, although there are differences between the mentor leader in organizations with and without the BSC, these differences are not statistically significant, so Hyp1. A is rejected.

Hyp1. B: Entrepreneurial leader style differs in organizations with and without BSC

In order to test the hypothesis under study, the Mann-Whitney test was performed for independent samples (Table 2).

Table 2: Entrepreneurial Leader

Variable	Without BSC			With BSC			Test applied	Z value	Sig.
	Average	STD deviation	STD sample error	Average	Sample Deviation	STD average errors			
Hyp1. B: Entrepreneurial Leader	3,51	1,683	0,231	2,7	1,381	0,218	U de Mann-Whitney	-2,273	0,023

Source: self-elaboration

Considering the results obtained in the Mann-Whitney U test ($p\text{-value} = 0.023 < 0.05$), we conclude that there are differences between the entrepreneurial leader style in the organizations with and without the BSC and these differences are statistically significant, whereby Hyp1. B is confirmed.

It is recognized in the literature that organizations without the BSC stress the importance of entrepreneurship and innovation, which makes them more likely to take risks. This qualification is in accordance with the most dominant type of culture, namely Adhocracy.

Hyp1. C: Coordinator leader style differs in organizations with and without BSC

Regarding the coordinating leader, to test the hypothesis under study, the Mann-Whitney test was performed for independent samples (Table 3).

Table 3: Coordinator Leader

Variable	Without BSC			With BSC			Test applied	Z value	Sig.
	Average	STD deviation	STD sample error	Average	Sample Deviation	STD average errors			
Hyp1. C: Coordinator Leader	3,09	1,418	0,186	3	1,298	0,208	U de Mann-Whitney	-0,008	0,994

Source: self-elaboration

Considering the result obtained in the Mann-Whitney U test ($p\text{-value} = 0.994 > 0.05$), it is concluded that the style of coordinating leader differs in the organizations with and without the BSC. However, these differences are not statistically significant, so Hyp 1. C is rejected. Organizations that have the BSC implemented are characterized of having a market organizational culture, so that their leaders are considered as focused on production and the decisions related to production.

Hyp1. D: Executive leader style differs in organizations with and without the BSC

Regarding the style of executive leader, to test the hypothesis under study, the Mann-Whitney test was performed for independent samples (Table 4).

Table 4: Executive Leader

Variable	Without BSC			With BSC			Test applied	Z value	Sig.
	Average	STD deviation	STD sample error	Average	Sample Deviation	STD average errors			
Hyp1. C: Executive Leader	1,64	1,078	0,166	2,16	1,393	0,25	U de Mann-Whitney	-1,810	0,070

Source: self-elaboration

Considering the results obtained in the Mann-Whitney U test ($p\text{-value} = 0.070 > 0.05$), it is concluded that, although there are differences between the executive leader style in BSC and non-BSC organizations, these differences are not statistically significant, whereby Hyp1. D is rejected. If we considered a level of significance at 10%, we would not reject Hyp1. D.

7 Discussion and conclusions

Throughout this investigation we concluded that, as regards the differentiation of cultural characteristics, the profile of the leader in organizations with and without the BSC is significantly different. In our view, this analysis and conclusion is important, in particular to gain a better understanding of the cultural aspects, as emphasized by Schein (2004) and the style of leadership. It is seen that organizations with the BSC consider their leader as an entrepreneur, which may be related, in an intrinsic way, to the Market cultural profile, which characterizes the organizations with the BSC.

Schein (2004) states that a deeper understanding of cultural issues related to groups and organizations is essential to understand groups and their priority issues for both leaders and their leadership. This understanding is relevant because organizational culture is mostly encouraged by leaders, since the creation, management, and sometimes even change of culture is one of the most decisive functions of leadership.

It is in this sense that organizations with BSC characterize their leaders as entrepreneurs (with a statistical significance of 5%), while non-BSC organizations classify their leaders as executives (with a significance level of 10%). From the analysis to the obtained results, it was ascertained that, considering a significance of 5%, Hyp1. B was not rejected: The style of entrepreneurial leader differs in organizations with the BSC from those without it.

This research thus fulfills its specific objectives responding to the research question insofar as it identifies in what kind of leadership styles organizations without the BSC differ from organizations with it. Considering that the leadership profile is a way to achieve cultural changes, this research has been able to bring innovative knowledge, highlighting its relevance for both the academia and the organizations. It is recognized that leadership style has an

impact on the implementation and monitoring of management tools as well as on the conduct of organizational performance.

We reiterate through the present study the differences in leadership style in organizations with and without the BSC, so that they should be considered when implementing and monitoring Management tools and following organizational performance.

8 Future research avenues

This research confirmed that the leadership style in organizations with and without the BSC in Portugal is different, so we believe it will be pertinent to carry out the same study in other geographies and to compare the results. In addition, we consider that this quantitative study can be solidified through the triangulation of data, including interviews in real work context, to determine the managers' perception about the different styles of leadership. On the other hand, we consider that it is of interest to assess the employees' perception of the leaders' cultural profile.

Finally, we consider that it is relevant for this research area to carry out a Multi-Case Study, in order to be able to compare the reality in several organizations and to extract more in-depth information (3-5 organizations), to gather information on hand of Focus Groups.

References

- Barney, J. (1986). Organizational Culture: Can It Be a Source of Sustained Competitive Advantage? *Academy of Management Review*, 11(3), 656–665. <http://doi.org/10.2307/258317>
- Barreto, L. M. T. D. S., Kishore, A., Reis, G. G., Baptista, L. L., & Medeiros, C. A. F. (2013). Cultura organizacional e liderança: uma relação possível? *Revista de Administração*, 48(1), 34–52. <http://doi.org/10.5700/rausp1072>
- Brown, A. D. (1998). *Organizational Culture*. London: Financial Times Management.
- Cameron. (1985). *Cultural Congruence, Strength, and Type: Relationships to Effectiveness* (No. Graduate School of Business Administration). Michigan.
- Cameron, K., & Freeman, S. (1991). Cultural Congruence Strength and Type: Relationships To Effectiveness. *Research in Organizational Change And Development*, 5, 23–58.
- Cameron, K., & Quinn, R. E. (1999). *Diagnosing and Changing Organizational Culture*. San Francisco: Jossey-Bass. http://doi.org/10.1111/j.1744-6570.2006.00052_5.x
- Cameron, K., & Quinn, R. E. (2005). *Diagnosing and Changing Organizational Culture: Based on the Competing Values Framework (Revised Edition)*. San Francisco: Jossey-Bas.
- Daft, R. L., & Weick, K. E. (1984). Toward a Model of Organizations as Interpretation Systems. *The Academy of Management Review*, 9(2), 284. <http://doi.org/10.2307/258441>
- Denison, D. R., Hooijberg, R., & Quinn, R. E. (1995). Paradox and Performance: Toward a Theory of Behavioral Complexity in Managerial Leadership. *Organization Science*, 6(5), 524–540. <http://doi.org/10.1287/orsc.6.5.524>
- DiMaggio, P. (1997). Culture and Cognition *. *Annual Review of Sociology*, (23), 263–287.
- Drucker, P. (1954). *The Practice of Management*. New York: HarperCollins.

- Finkelstein, S. (1990). Top-Management-Team Tenure and Organizational Outcomes : The Moderating Role of Managerial Discretion. *Administrative Science Quarterly*, 35(3), 484–503. Retrieved from <http://pubsonline.informs.org/doi/abs/10.1287/orsc.6.5.524>
- Gallagher, S., Brown, C., & A, L. B. (2008). A Strong Market Culture Drives Organizational Performance and Success. *Employment Relations Today*, 25–31. <http://doi.org/10.1002/ert>
- García-Valderrama, T., Mulero-Mendigorry, E., & Revuelta-Bordoy, D. (2008). A Balanced Scorecard framework for R&D. *European Journal of Innovation Management*, 11(2), 241–281.
- Guba, E. G., & Lincoln, Y. S. (1994). *Competing Paradigms in Qualitative Research*. (N. K. D. & Y. S. Lincoln, Ed.) *Handbook of qualitative research*. Thousand Oaks: Sage Publications. <http://doi.org/http://www.uncg.edu/hdf/facultystaff/Tudge/Guba%20&%20Lincoln%201994.pdf>
- Harris, L., & Ogbonna, E. (2002). The Unintended Consequences of Culture Interventions: A Study of Unexpected Outcomes. *British Journal of Management*, 13, 31–49.
- Heizmann, L., & Lavarda, C. (2011). Cultura organizacional e o processo de planejamento e controle orçamentário organizational culture and the process of planning and budget control. *Revista de Contabilidade E Organização*, 5, 4–19. <http://doi.org/10.11606/rco.v5i13.34801>
- Kaplan, R. S., & Norton, D. P. (1992). The balanced scorecard - measures that drive performance. *Harvard Business Review*, (January-February), 71–79.
- Kaplan, R. S., & Norton, D. P. (1993). Putting the Balanced Scorecard to Work. *Harvard Business Review*, 71, 134–147. <http://doi.org/10.1177/1056492604268208>
- Kaplan, R. S., & Norton, D. P. (1996). *The Balanced Scorecard: Translating Strategy into Action*. Boston: Harvard Business School Press,.
- Kaplan, R. S., & Norton, D. P. (2000). Having Trouble With Your Strategy. *Harvard Business Review*, 5, 167–176.
- Kaplan, R. S., & Norton, D. P. (2001a). Leading change with the balanced scorecard. *Financial Executive*, 17(6), 64–66. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=11861223&site=ehost-live>
- Kaplan, R. S., & Norton, D. P. (2001b). Transforming the balanced scorecard from performance measurement to strategic management: Part 1. *Accounting Horizons*, March, 87–104.
- Kaplan, R. S., & Norton, D. P. (2007). Using the Balanced Scorecard. *Harvard Business Review*, Managing f(January-February), 150–161.
- Lessard-Hébert, M., Goyette, G., & Boutin, G. (2010). *Investigação qualitativa. Fundamentos e práticas*. Lisboa: Instituto Piaget.
- Lok, P., & Crawford, J. (2004). The effect of organisational culture and leadership style on job satisfaction and organisational commitment: A cross-national comparison. *Journal of Management Development*, 23(4), 321–338. <http://doi.org/10.1108/02621710410529785>
- Macmillan, I. C., Farh, J.-L., & Chen, M.-J. (1993). An Exploration of the Expertness of Outside Informants. *Academy of Management Journal*, 36(6), 1614–1632. <http://doi.org/10.2307/256823>
- Mooraj, S., Oyon, D., & Hostettler, D. (1999). The balanced scorecard: a necessary good or an unnecessary evil? *European Management Journal*, 17(5), 481–491. [http://doi.org/10.1016/S0263-2373\(99\)00034-1](http://doi.org/10.1016/S0263-2373(99)00034-1)
- O'Reilly, C. A., & Chatman, J. A. (1996). Culture as social control: corporations, cults, and commitment. *Research in Organizational Behavior*, 18, 157–200. <http://doi.org/Article>
- Osório, J. (2009). *Learning Organizations: As práticas de gestão de recursos humanos e o papel da cultura organizacional*. Universidade do Minho.

- Ouchi, W. G. (1980). Markets, Bureaucracies, and Clans. *Administrative Science Quarterly*, 25(1), 129–142. <http://doi.org/10.2307/2392231>
- Porter, M. E. (1992). Capital Disadvantage : America / s Failing Capital Investment System. *Harvard Business Review*, (september october 1992), 65–82.
- Quinn, R. E. (1984). *Applying the competing values approach to leadership: Toward an integrative framework. Leaders and managers: International perspectives on managerial behavior and leadership*,. New York: Pergamon.
- Rohit, D., Frederick, E., & Webster, J. (1989). and Organizational Defining the Marketing : Research Agenda. *Journal of Marketing*, 53(1), 3–15. <http://doi.org/10.2307/1251521>
- Sathe, V. (1983). Implications of corporate culture: A manager’s guide to action. *Organizational Dynamics*, 12(2), 5–23. [http://doi.org/10.1016/0090-2616\(83\)90030-X](http://doi.org/10.1016/0090-2616(83)90030-X)
- Schein, E. H. (1996). Culture : The Missing Concept in Organization Studies. *Administrative Science Quarterly*, 41(2), 229–240.
- Schein, E. H. (2004). *Organizational culture and leadership*. (Jossey-Bass, Ed.) (3rd ed.). San Francisco.
- Shahzad, F. (2012). Impact of Organizational Culture on Organizational Performance : An Overview. *Interdisciplinary Journal of Contemporary Research in Business*, 3, 975–985.
- Shim, S., Lusch, R., & O’ Brien, M. (2002). A Hierarchical Model of Values , Leadership , Job Satisfaction and Commitment : Human Resources Management Implications for the Retail Industry. *Journal Of Marketing Channels*, 10(1), 65–87.
- Smircich, L. (1983). Concepts of culture and organizational analysis. *Administrative Science Quarterly*, 28, 339–358. <http://doi.org/10.2307/2392246>
- Suma, S., & Lesha, J. (2013). Job Satisfaction and Organizational Commitment : the Case of Shkodra Municipality. *European Scientific Journal*, 9(17), 41–51.
- Tichy, N. M. (1982). Managing Change Strategically: The technical, political, and cultural keys. *Organizational Dynamics*, 11(2), 59–80.
- Whetten, & Cameron. (2005). *Developing Management Skills*. (6th (international) Edition, Ed.).
- Wong-On-Wing, B., Guo, L., Li, W., & Yang, D. (2007). Reducing conflict in balanced scorecard evaluations. *Accounting, Organizations and Society*, 32(4–5), 363–377.

Building the ENRICH Community – Common European Network as Advantage for ENRICH in Brazil, China and in the USA

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Abstract: This paper investigates the benefits and risks of cooperation on the case of the European Network of Research and Innovation Centres and Hubs (ENRICH), which is currently being established in Brazil, China and the United States. Funded by Horizon 2020, an initiative of the European Union to foster research and innovation, the programme seeks to consolidate a European network in the field with other important regions of the globe. In this scenario, it is argued that building a common European community would bring more incentives and benefits to ENRICH than having a separate one for each centre, in line with noteworthy economic theories. By creating an even stronger strategic network, the ENRICH initiative could make use of its biggest assets – its partners and acting markets – to strategically insert itself into the global innovation ecosystem as a major player.

Keywords: ENRICH; Network Approach; Global Innovation Ecosystem; Community Concept; Organisational Structure

1 Introduction

The European Network of Research and Innovation Centres and Hubs (ENRICH) is an initiative promoted by the European Commission with the objective of connecting European research, technology and business organisations to partners in other regions. By promoting the internationalisation of European science, technology, and innovation, this global network envisages obtaining gains in terms of efficiency and access to potentially fruitful markets, bringing benefits to all parts involved. As of 2018, three ENRICH centres have started their operations: In Brazil, China, and the United States of America.

The participation of institutions from different backgrounds and roles, comprising academic, industrial, and governmental organisations, in a so-called “triple helix” structure, is seen as key for modern innovation strategies (Etzkowitz & Leydesdorff 1995). Based on that, the ENRICH centres are structured in a way that provides the interaction between these distinct approaches, as seen in the numerous partner institutions on each country. This diversity can also be seen among the European partners, what shows the character of bilateral cooperation between the parts involved.

The current community of European partners is, however, decentralized, with some institutions acting as associates for more than one country, whereas others focus their efforts in just one specific market. Being the current centres still pilot projects, the advantages or disadvantages of such approach are yet somewhat unclear, creating the need for a deeper research regarding these aspects. That way, this paper aims to analyse the possible gains that having a joint European community would bring to the current ENRICH centres and potential new ones, as well as the challenges that such measure could face. It is argued that, despite some conceivable obstacles, having a common network for all centres could improve the capability of all partners to achieve a greater competitiveness through knowledge gain and accelerated innovation processes, made possible by the greater diversity of know-how available.

Besides this short introduction, the second section of this work discusses the theoretical background regarding the advantages of having access to greater and more diversified markets, from a microeconomic perspective, and the insertion of ENRICH in this scenario, with an examination on the possible barriers or disincentives to this framework. The third section examines the economic conditions of the current ENRICH partner countries and their growing potential, linking them to the initiative's prospects in the event of a joint European community and comparing the outcome with the existing scenario. Final remarks on the proposal and its expectations finish the work.

2 ENRICH in theory and practice

2.1 Theoretical background

The importance of constructing a connected business network on a global level has increased constantly over the last decades. With the economic transformation brought by the advances on ICT (information and communications technology), the phenomenon of internationalisation of operation stages of a firm became a key element of corporate competitiveness (Fung 2013), with the participation on global value chains increasingly determining the survival (or extinction) of diverse companies. Similarly, internationalising supply chains is often associated to offshoring know-how, since production processes, transportation, management techniques, among others, have to be replicated in other places, creating spill-overs that surpass the simple creation of new job positions and increasing the international mobility of technology (Baldwin 2013).

Both facets of this process seem to complement each other in a virtuous cycle: to gain competitiveness, a company must internationalise its production processes to places with lower costs (which are usually related to low wages), while offering local access to its technology and good practices, thus assisting these places to develop their own technology and human capital. Nevertheless, this does not explain the whole picture of how having multiple branches of operation can result in clear benefits over simply transferring the production processes to a single highly advantageous country, in terms of costs and availability of skilled labour, for instance.

In a scenario of free trade and reduced transaction costs due to modern ICT, the concept of economies of scale (as shown in Steindl 1990) – if considered in isolation – seems to contradict the idea of having multiple centers of production (or creation of knowledge) in several places. On the other hand, the already classic portfolio theory (Markowitz 1952) states the importance of having distinct operation branches, to optimize resources allocation while reducing risk. That way, some aspects that are not easily measurable seem to be essential to understand the dynamics proposed. The missing link can be found in the idea of economies of scope: according to Panzar & Willig (1981), these happen when the production of different goods brings gains to their unitary costs, because the firm operation can cover different demand groups (for each product) while sharing fixed costs, such as marketing, management, or R&D, between all of them. Thus, it would be possible to obtain gains and a higher efficiency by centralizing some activities, while maintained risks in a controlled level by ‘not putting all eggs in the same basket’.

Still, it is not always clear which activities should be centralized and which not, and this can even show a counterproductive side regarding costs and generate dilemmas on how to conduct the business in a more efficient way. One of the reasons to this is the very way different nations are structured, concerning their institutional frameworks. According to North (1990), the institutional arrangement of a country may foster or hinder its economic development, and more than that, there is a path dependency on these institutions – i.e., the current institutions are shaped according to the previous ones, and still carry strong connections to those.

The outcome of this is an ambient that determines profit opportunities and directs decisions, generating distinct trajectories born from the similar ideas and measures. The idea is made clearer when considering the paradigm of National Systems of Innovation (NSI) as defined by Freeman (1987): “networks of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies” (p.1). In other words, the synergy (or lack thereof) between institutions is what defines the creation or absorption of knowledge (sometimes materialized in technology), and the feasibility of such is, therefore, also determined by them. This way, opening a business in a new market is not only a matter of forecasting demand and growth figures: knowing how to work with its players and within its institutional framework is fundamental to achieve success, while avoiding solutions disconnected to its reality, or even anachronistic ones.

Ultimately, the interaction of such variables in this complex manner is what defines the triumph or failure of competitors while others take the opposite path. Likewise, the importance of innovation is evidenced when considering it as the decisive factor to survive in the hostile medium of market competition and the very generator of ‘creative destruction’ processes (Schumpeter 1942), and innovating, in a broader sense, demands the coordination of more than just hard elements, as summarized by Sweeney (1996):

‘Innovation ... is an outcome of new knowledge and information created and integrated through networks of people, who have core competence in a sectoral product and product engineering technology or discipline, interacting with people of other disciplines and functional know-how.’ (p. 17)

The need of a more holistic approach to the topic, considering more than just measurable variables, is adequately illustrated by this perspective. Moreover, a concept in this sense is fundamental to unleash from possible “one size fits all” policies and methods, which – if ever successful – are outdated and are not suitable to the 21st Century dynamic scenario, neither to the configuration of supply chains (Gattorna 2013) nor to the very creation and spreading of knowledge or updating of productive forces (Hodgson 2000). Being endowed with a diverse and well-connected network of partners seems like a valuable trail in this direction.

2.2 The ENRICH Network

Albeit not comprehending the typical productive firm structure, the European Network of Research and Innovation Centres and Hubs shows similarities to the ideas discussed. As an initiative composed of multiple partners with distinct backgrounds, the centres show strict relations to the *lato sensu* concept of innovation found in the literature.

Promoted by the European Commission through funding granted by Horizon 2020, an extensive research and innovation programme led by the European Union, the ENRICH network offers services and solutions to connect European partners to (as of 2018) Brazil, China, and the United States, all prominent countries in terms of innovation and potential markets. By acting directly with European and local partners in each country, the initiative seeks to build a community involving different levels of stakeholders, each with different roles and contribution possibilities, but all benefitting from the diversity of ideas and knowledge areas.

Besides the individuals, entrepreneurs, and researches, who are the main users of services provided by ENRICH, other players have a substantial role and are also part of the ENRICH Community, such as service providers, organisations willing and able to provide services under the umbrella of ENRICH, or soft-landing hubs, with characteristics similar to specialised service providers. Furthermore, the Community anticipates the inclusion of ambassadors and sponsors to its alliances selection, further supplementing and strengthening its ties.

The advantages of building a strong community of partners communicate directly with the concept of obtaining gains through business range and diversification – in other words, economies of scale and scope. Including more stakeholders interested in the initiative’s activities means not only having less expenditure per partner (by sharing common costs, e.g. legal and management expenses), but also being able to penetrate different markets and sectors by utilising the knowledge brought by partners with expertise in certain areas to improve the former.

The European Commission’s priority research and innovation fields for Brazil illustrate these points satisfactorily: fields like biotechnology, nanotechnology and renewable energy can profit from partnerships with institutions such as universities or research institutes, whose extensive knowledge pool could provide crossed solutions and perspectives, which would be otherwise unconsidered. In its turn, the higher demand for products and services created in these institutions could enlarge their economic viability and bring them competitive advantages, creating therefore a virtuous cycle of more knowledge generated with lower costs due to its comprehensiveness.

It is important to notice the role played by each sector in this stream: by condensing the main actors of a national system of innovation in three main branches – industry, universities, and the government (Goto 2000) – it is possible to observe a unique character for each participant, on top of their natural interaction. Whereas the industrial sector (or private sector) has motivations driven by market forces, with R&D as an expected outcome of it, universities play a role of creating knowledge and skilled workers to fulfil the needs of both the private and the public sector. The latter plays the essential role of creating and enforcing the legal basis in which the other players act, as well as regulating and creating stability to their *de facto* action, thus enabling the formation of a virtuous cycle with the participation of all sectors.

2.3. A common European community

From this point of view, the comprehensiveness of the ENRICH initiative seems to be one of its strongest points, with partnerships among different operating sectors and objectives that cover most of the discussed spectrum, in all partner countries and Europe. However, its current structure comprises a separate European community for each country, with partnerships signed individually between such stakeholders and the ENRICH centres abroad. Being pilot projects, the structure of these centres is still prone to transformations and realignments, seeking an optimal framework with benefits to all involved.

Among these, the proposal of consolidating one single European community with interface to all partner countries and their institutions, as a substitute to the current construction, is seen as a fruitful step to reinforce the ENRICH business model. By allowing a more extensive network to be reached with similar costs, unifying the European partners' portfolio would be a measure with definite ties to the concepts of economies of scale and scope, bringing the interconnection advantages to new levels. Figure 1 illustrates the change of configuration in this new setup:

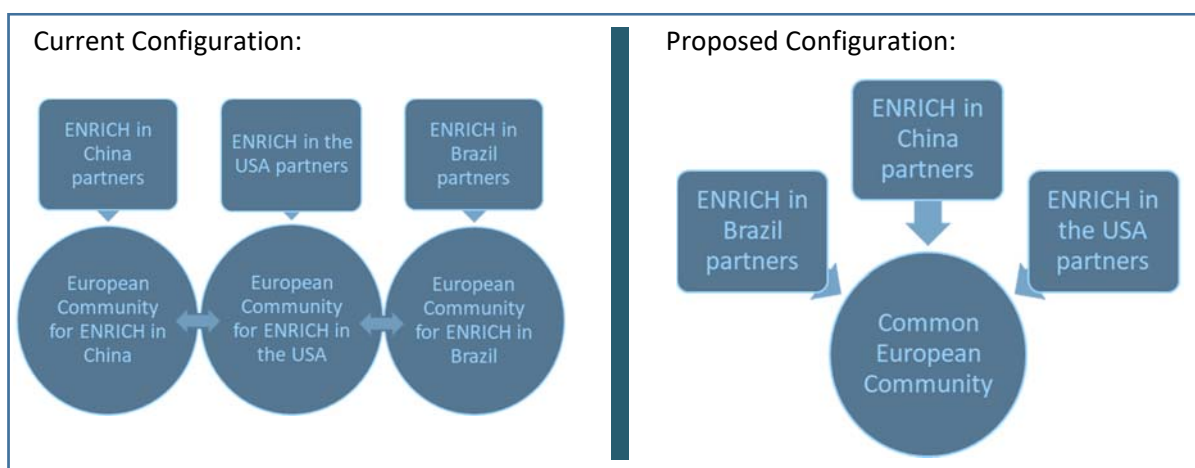


Figure 1: Current and proposed configurations of ENRICH communities

The first and most obvious positive effect of such a restructuring would be over the European partners that already take part in all three consortia (currently, EBN – *European Business & Innovation Centre Network*, and SPI – *Sociedade Portuguesa de Inovação*), who would not have the need to negotiate multiple instances of contribution, incurring in less time needed

and steps taken to firm partnerships. Secondly, the other current members of the European community would have their involvement expanded to countries they initially did not have a partnership with, having access to new knowledge pools for a relatively small effort. Likewise, future members of the European community would promptly have access to these advantages, increasing the attractiveness of the ENRICH initiative to new stakeholders.

The indirect outcomes of this refinement also seem to be rather inviting to the partners located abroad. While not having direct interaction with other countries' communities (e.g. a straightforward interface between the Brazilian and Chinese communities), having a common association, in the form of the European community, would enable a much easier exchange of information and solutions between these groups. With the current members being three of the most prominent countries in terms of knowledge creation, the impact of such indirect partnerships is far from negligible and can be exponentially increased with the intermediation of the European community. Moreover, on a more macroeconomic aspect, this would help to generate knowledge spill-overs inside the countries in which these partners are located, assisting in technology creation and catching-up (Di Cagno et al. 2014), fundamental condition to economic development.

Furthermore, these results would not be seen only in the present ENRICH centres, but would rather also play a major role in possible new locations and cooperative measures, further strengthening the advantages discussed. From a long-term perspective, having access to a more flexible and growing strategic network means not only increasing participation in already dynamic markets and their knowledge pools, but also reducing possible risks brought by economic fluctuations or other externalities. Ultimately, consolidating the European community seems to be a natural step to the ENRICH initiative in the maturity direction, with tangible benefits. Nevertheless, such a framework shift is expected to be accompanied by challenges and obstacles, which have to be carefully thought out in order to avoid complications and possible shortcomings, diminishing the expected gains.

2.4 Challenges and Obstacles

To implement this new structure, it is mandatory to consider that the interaction between the three main sectors of a national system of innovation is more complex and diverse than assigning definite roles for each institution. Different countries show different participation degrees of the public and private sector in technology creation, with these relations being occasionally intertwined (e.g. State universities, such as Unicamp in Brazil, or Tsinghua University, in China). This leads to the necessity of distinct conduction of contracts firmed between the European and abroad partners, regarding e.g. the level of inclusion of local governments in the ENRICH programme, as well as their roles. Likewise, cultural and socioeconomical differences, although more abstract concepts, must be understood and managed carefully to achieve the desired outcomes, and these evidently vary among the partner countries.

These dissimilarities manifest themselves also within the legal framework of each national state and their subdivisions, surely impacting the proposed business structuring. However, while this factor represents a major source of necessary work, it does not seem to pose an

obstacle or impediment to unifying the ENRICH European community, since the actual framework already works with different juridical entities. In reality, after a first effort of identifying possible similarities and divergences on these spheres, the task of dealing with local authorities can be simplified and made leaner over time, due to the shared knowledge built in between. Thus, provided that the local characteristics (also in the qualitative level) are taken into account, this joint work can represent one of the strongest points of the proposed shift.

While the restructuring planning stage does not seem to face greater challenges, other than avoiding possible oversimplifications, some elements might affect the participation of the community members in the scheme. The first question concerns what the literature calls “adverse selection” issues, when asymmetric information is put into the equation (Maskin & Riley 1984). In the ENRICH case, being partner of numerous institutions in several markets represents being more susceptible to not having information about partners’ actuation, results and intentions – therefore, increasing the risk of participating. That way, diminishing this disincentive is mandatory and requires the supply of clear and updated information on all partners, from their parts and the ENRICH coordination as well.

This clear and predictable kind of providing information also reduces the new framework’s moral hazard aspect. Being summarized as “any situation in which one person makes the decision about how much risk to take, while someone else bears the cost if things go badly.” (Krugman 2009, p. 63), it shows connections to possible attitudes such as ‘free riding’, with participants benefitting disproportionately *vis-à-vis* their contribution to the initiative, whereas possible complications would be equally distributed among all partners.

Fundamentally, the challenges foreseen seem to be consistently diminished by a robust and well conducted coordination, providing quality information to all involved parts and avoiding non-optimal practices. This, allied to simplifying possible redundant structures, seems like a natural development to the ENRICH initiative, and possible higher costs in a first moment should be more than compensated by its advantages, especially considering the highly promising environment in which centre is located.

3 The ENRICH environment

Creating a sturdy long-term network brings undoubtedly a favoured position to all parts involved in an initiative like ENRICH. However, reaching this goal is strongly prone to externalities, and planning strategically to avoid problems engendered by variables that cannot be easily tackled is mandatory to achieve the desired success. From this perspective, the current ENRICH partnership with three of the most prominent economies in the world appears as one of its main assets and represents a strong incentive for its members to take part in associating with more than one market. This way, it is important to analyse the economic conditions of Brazil, China and the United States, as well as their science and technology fostering initiatives, in order to identify the right steps to be taken next and the potential of a conjoint partnership with institutions of all countries.

3.1 Brazil

Being the largest South American economy and eight largest of the world, Brazil shows itself as an important strategic player in the global markets. With a huge population (more than 206 million inhabitants), area (8.5 million km², fifth larger country in the world), and resources endowment, the country is one of the markets with the greatest potential to grow and consolidate itself as a global player.

During the last decades, Brazil has shown a strong increase in its number of scientific publications, PhD degrees obtained, and patent applications (Pedrosa & Chaimovich 2015), as a result of the country's economic boom throughout the 2000's and the consequent investment in the sector carried out by the Ministry of Science and Technology. Its agricultural sector's productivity has increased its productivity constantly since the 1970's, being one of the most important economically, as well as strong investments in key sectors such as energy (with Petrobras, its largest company, registering more patents than any other company in the country) and nanotechnology (*ibid.*).

Despite these achievements, the country still lags behind other outstanding economies in terms of innovation and competitiveness, and the sharp economic crisis the country faces since 2014 put a halt to the process continuation. Nevertheless, this decline seems to be slowly overcome, with macroeconomic factors such as inflation, interest rates and terms of trade having improved in the last year (Krznar & Matheson 2018). That way, it is expected that resumed the economic dynamism, the country will be able to progress in its development process and utilize its potential to continue generating innovative knowledge, placing the ENRICH centre in a very advantageous position to its members and the country itself.

3.2 China

China is a well-known powerhouse. With an average GDP growth rate of over 9,7 percent per year between 1978 and 2009, accompanied by a similar high and steady growth in investment and productivity (Aglietta & Bai 2013), the country became not only the greatest economy in Asia, but also the second greatest in the world, and still shows a greater economic dynamism than the global average. Its population of almost 1.5 billion people and area of more than 9,5 million km² also denote the economic importance of this country in the world and gives a glimpse of its potential to thrive.

With a growing share of its GDP being invested in research and development, the country is expected to be the world leader in the area as early as 2019, and the results of this massive effort can be seen in the closing gaps in major sectors such as information and communication technology, advanced manufacturing, or biotechnology (Cao 2015). It is also important to highlight that these achievements are not simply a direct outcome from the immense Chinese economic growth, but rather an active development strategy undertaken by its government to foster scientific production and institutions, whose fruits are in the process of getting ripe. Likewise, when considering the Belt and Road Initiative (which will expand the Chinese prowess to other regions like Central and Southeast Asia, and Africa), this scenario seems even brighter to initiatives like ENRICH. Greatly benefitting from this dynamic ecosystem and

offering its partners a chance to create a strong network within it is essential to face the twenty-first century challenges and appears to be the logical step to be taken.

3.3 United States of America

With a population of around 325 million people and a total area slightly larger than China's (9.8 million km²), the United States of America are the most powerful country in the world in many aspects, including economically. Also, being currently the greatest spender in research in development in the world, the country is in the core of virtually all state-of-art technological fields, management practices, and financial services. Slowly but surely recovering from the financial crisis of 2008, which led to a sharp drop in its economic vigour, the USA have been able to maintain their academic strength consistently and even increase it in some areas, with the number of postdoctoral researchers going up by 150% between 2000 and 2012. Moreover, the country is unrivalled in matters of trade in intellectual property, with income from royalties and licensing four times higher (US\$ 129.2 bi vs. US\$ 31.6 bi) than of Japan's, the second strongest player in the field (Stewart & Springs 2015).

This impressive result comprises practically all knowledge areas, but the fields of biological and medical sciences must be highlighted, which together counted with more than one million new scientific publications in the period 2008-2014 (*ibid.*), demonstrating the country's qualifications and potential in the field. Also, differently from other regions, technological development in the USA is mostly financed by private actors, namely the industrial sector (76.4% in 2012), representing an interesting model to take part into. This way, entering this massive market through partnerships with local entities seems a very important step to the ENRICH community, who could benefit from the USA excellence in the whole spectrum, from cutting-edge technology and processes to best practices within the private sector and its relations with the government.

3.4 A two billion people market

Being an advanced initiative, the ENRICH centres must seize the opportunities provided by the countries in which they are located to generate a virtuous setting. Considering the current pilot centres, located in three of the most economically important countries in the world, this condition seems to be solidly covered, with exceptional future perspectives. This point of view intensifies the reasoning behind unifying the European community of the ENRICH initiative also through the extent of such structure in terms of market insertion. Whereas building a network of partners all around the world is essential, the *locus* in which these act is of undeniable importance to their business.

This way, provided the right framework and support from the coordinative side, it would be possible to the European stakeholders to operate in countries which together comprise more than 2 billion inhabitants and are pioneers in the creation of science, technology and innovation. This is one of the most outstanding assets of the ENRICH initiative, and an advantage that should be held and used to further improve its eminence as a global knowledge production centre.

4 Final remarks

In a context of increasing dynamism like in the 21st century, creating connections and network shows itself as a fundamental stone to adapt and consolidate a business in this situation. The ENRICH initiative is already built with this concept in mind, by taking advantage of an important community made up of innovative and visionary stakeholders, acting in the European market with excellence.

By creating an interface with the centres in Brazil, China, and the United States, the programme seeks to further strengthen these advantages and build an even more solid network, what seems like the instinctive development of an initiative of such nature. Likewise, this approach is firmly associated with the concepts and points of view of the Horizon 2020 programme, and acts in line with the idea of spreading the European eminence in innovation and best practices to other regions of the globe.

Nevertheless, it is possible to further improve the network between all ENRICH partners by changing its structure in a strategic way, with predicted costs much lower than the advantages it would bring. By unifying the European community and its members being able to partner with associates from all three pilot centres, the advantages brought by economies of scale and scope, risk diversification, among others, can be exponentially increased, with benefits to all participants. This seems to be the optimal framework to the ENRICH initiative not only in the present but would also enable an opportune future insertion of both new members and new centres, who could make use of the extensive and interconnected knowledge pool erected beforehand.

It is important, however, to keep in mind the diverging points between the countries in which centre is inserted, as well as Europe, regarding culture, legal framework, market characteristics, etc. While this may seem like an obstacle, this diversity of environment can be also seen as a strong asset ENRICH has access to, since local practices, motivation and ways of working can be shared among all partners, increasing even more their knowledge and network. The cooperative aspect is key to achieve that, from the perspective that no “one size fits all” policies would be implemented, but rather a harmonious effort in order to overcome the challenges imposed.

The same is valid for the markets in which the current centres are inserted. Being huge and strategic players in the global markets, Brazil, China, and the United States, allied with the European Union, are possibly the best setting to a vast initiative like ENRICH. With such a background, its potential to flourish is ample, and having access to all these markets at once is very inviting to any business. Therefore, the conjoint effort brought by a common European community seems like the next stepping stone to consolidate ENRICH as a global player in the innovation field and build the basis to its future acting.

References

- Aglietta, M., & Bai, G. (2013). *China's Development: Capitalism and empire*. New York: Routledge.
- Baldwin, R. (2013). Global supply chains: why they emerged, why they matter, and where they are going. In D. K. Elms, & P. Low, *Global value chains in a changing world* (pp. 13-60). Geneva: WTO Publications.
- Cao, C. (2015). China. *UNESCO Science Report: Towards 2030*, pp. 620-641.
- Di Cagno, D., Fabrizi, A., & Meliciani, V. (2014, December). The impact of participation in European joint research projects on knowledge creation and economic growth. *The Journal of Technology Transfer, Vol. 39(6)*, 836-858.
- Etzkowitz, H., & Leydesdorff, L. (1995). The Triple Helix - University-Industry-Government relations: a laboratory for knowledge based economic development. *EASST Review(14, nr. 1)*, 14-19.
- Freeman, C. (1987). *Technology, Policy, and Economic Performance: Lessons from Japan*. London: Pinter Publishers.
- Fung, V. K. (2013). Governance through partnership in a changing world. In D. K. Elms, & P. Low, *Global value chains in a changing world* (pp. xix-xxiii). Geneva: WTO Publications.
- Gattorna, J. (2013). The influence of customer buying behaviour on product flow patterns between trading countries, and the implications for regulatory policy. In D. K. Elms, *Global value chains in a changing world* (pp. 221-244). Geneva: WTO Publications.
- Goto, A. (2000). Japan's National Innovation System: Current Status and Problems. *Oxford Review of Economic Policy*(vol. 16, no. 2), pp. 103-113.
- Hodgson, G. M. (2000). Socio-economic Consequences of the Advance of Complexity and Knowledge. In OECD, *The Creative Society of the 21st Century* (pp. 89-112). Paris: OECD Publications.
- Krugman, P. (2009). *The return of depression economics and the crisis of 2008*. London: Norton & Company Ltd.
- Krznar, I., & Matheson, T. (2018). *Investment in Brazil: From Crisis to Recovery*. IMF Working Paper.
- Markowitz, H. (1952, March). Portfolio Selection. *The Journal of Finance*(vol. 7, no. 1), pp. 77-91.
- Maskin, E., & Riley, J. (1984). Monopoly with incomplete information. *The RAND Journal of Economics, vol. 15, no. 2*, 171-196.
- North, D. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.
- Panzar, J. C., & Willig, R. D. (1981, May). Economies of Scope. *The American Economic Review*(Vol. 71, no. 2), pp. 268-272.
- Pedrosa, R. H., & Chaimovich, H. (2015). Brazil. *UNESCO Science Report: Towards 2030*, pp. 210-229.
- Schumpeter, J. (1942). *Capitalism, Socialism and Democracy*. New York: Harper & Row.
- Steindl, J. (1990). *Pequeno e Grande Capital: Problemas Econômicos do Tamanho das Empresas*. São Paulo: Ed. Hucitec/Ed. Unicamp.
- Stewart, S., & Springs, S. (2015). United States of America. *UNESCO Science Report: Towards 2030*, pp. 128-155.
- Sweeney, G. (1996). Learning Efficiency, Technological Change and Economic Progress. *International Journal of Technology Management(1/2)*, pp. 5-27.

Some Adverse Factors Influencing Managers' Decisions

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Abstract: This paper describes typical faults committed by managers at decision-making and factors fostering mistaken decisions. First, specific features of managerial decisions are characterized and how the managers are influenced by the environment in which they work. The impact of individual beliefs and assumptions of managers as well as consequences of their ignorance, bias or prejudice are described in details. The subject is completed by critical remarks on team decisions. The second part of the paper addresses mistakes and failures in product developments that managers are responsible for. Detrimental effects of neglecting market needs, of chaotic organization of production, and of ignoring principles of design for easy manufacturing are pointed out.

Keywords: Characteristics of managers, failures in management, wrong decisions, product development

1. Introduction

In contrast to prevalent recommendations in literature of the subject and other sources which address how to manage for success, the author identifies causes that may contribute to wrong decisions in solving managerial problems.

There are many crucial factors which create opportunity for decision mistakes and/or failures. One is environment in which managers make decisions. Other causes addressed in the paper are named in order:

1. General faults of management process caused by environment of managers,
2. Personal shortcomings of managers' knowledge, ability and attitude,
3. Improper evaluation of market needs and company's resources,
4. Faults in product design, production planning, and technology.

Identification and awareness of possible failures can help managers avoid them, therefore contributes to efficient management.

2. Specific features of managerial decisions

A manager is the person on a head position who possess necessary knowledge and skill to control people and to administer organizations in circumstances of their function (Penc 1997).

She or he is someone who is responsible for realization of the management process, and especially who plans and makes decisions, organizes, leads the subordinates and supervises working, financial, material, and informational resources (Griffin 2004). The managers' responsibility does not depend on their personal achievements but on assisting the others in performing their tasks. They coordinate and inspect the others working in order to achieve goals of the organization (Robbins and Coulter 2012).

There are many definitions of the term "*Decision*". In this paper it has been accepted that a decision is the act of choice of a possibility (or a combination of a number of possibilities) of achieving of the desirable objective. This act usually results from analysis and evaluation of a number of alternatives which potentially may serve to reach the objective.

Decision making and *problem solving* should not be identified although they often are close linked each other - fact that sometimes causes interchangeable use of these terms. These notions, however, should be distinguished, because decisions contain the evaluation which directly leads to an action; decisions always precede activity. In contrast, a solution of the problem can be a final result of the process. However, according to (Bolesta-Kukułka 2003), managers' decisions involve functioning other workers (executors). Therefore, not the choice of a problem solution but the decision of action is the essence of the manager's decision.

Some types of decision need problem solving but other does not. Therefore, although decisions and problem solving are related each other but they are not interchangeable. This statement differs from that in (Penc 1997) where decisions and problem solving are strongly related.

Typology of decisions is very diverse (Simon 1982; Bolesta-Kukułka 2003). In this paper only three of many are quoted. According to Penc there are three categories of managers' decisions: (i) Operative ones that are related with current running of the enterprise, (ii) Tactical decisions, that concern efficient realization enterprise's objectives in concert with its strategy, (iii) Strategic decisions that specify the long-term objectives of the enterprise. Other classification distinguishes decisions taken individually or collectively and on level of an organization or on meta-organization. Yet other authors make distinction between routine, adaptive or creative decisions.

No matter of the decision nature it is generally accepted that act of decision is the essence and integral part of management (Harrison 1999). It is the act that activates dynamics of the management process.

Bolesta-Kukułka (Bolesta-Kukułka 2003) makes distinction between decisions *reactive* that are response towards past events and *proactive*, that are based on a future prediction. Magdalena Wyrwicka describing problem situations that organizations have to deal with defines proactivity as dealing with a future subject despite a lack of actual emergence of related problems (Wyrwicka 2016).

Russel Ackoff described proactive approach as reverse planning – from ideal conception to reality. He emphasized that the proactivity does not have limitations of the reactive approach. Proactive managers can imagine future events and initiate reasonable actions in advance

(Ackoff 1979; Ackoff 1993). Simultaneously to Ackoff the term '*ideals concept*' for solution of design problems introduced Gerald Nadler (Nadler 1979; Nadler and Hibino 1989).

According to (Urban and Hauser 1993) the choice between proactive or reactive approaches is considered as one of the most important strategic decisions.

3. Impact of environment on managers' decisions

Organizations are open systems that need careful management to satisfy and balance internal needs and to adapt to environmental circumstances (Morgan 1986). They not only respond to changes in the environment but also act to influence and co-create them. (Volberda 1998) in his analysis of factors influencing capability of organization to change explicitly made difference between internal and external flexibility (Table 1). He noticed that usually exists some unfit of strategic choice and different organizational configurations to the environmental features that may be reduced by the flexibilities.

Table 1 Internal versus external flexibility (adapted from Volberda 1998)

Internal flexibility adapting		External flexibility influencing	
Reactive (corrective)	Anticipative (pre-emptive)	Defensive (protective)	Offensive (exploitive)

Internal flexibility refers to the capacity to quickly adapt to the demands of the environment. This is necessary to survive. External flexibility is the capacity of an organization to actively influence the environment to reduce its ability to affect the organization.

Accomplishment of effective adjustment of the organization to the environment is the major part of the manager's duty. Managerial choice defines and refines an organization's structure and process. To great extent managers' behavior follows the internal structure, hence the efficiency and effectivity of the organization depend on how its human capital and structure fit to the environment challenges. The cycle of managing change process is effective only on condition that managers – in particular top managers – are able to learn how to gain experience from the past and how they proactive are prepared for the future.

Managing change for competitive success can be summarized to a following cycle:

Environmental assessment → understanding need of strategic change → diagnosing strategic change needs → identification of leading change → involvement of human resources into the change realization → ensure linking strategic and operational change as well as coherence → back to environmental assessment → ...

The cycle is like learning process: managers and staff in the organization see their role as keeping close to and responding to signals in the environment. Ensuring coherence means that the organization needs to possess ability to hold its performance together in efficient way, while simultaneously changing itself. Thus, the task of successful organizational change

and development depends on bringing variables into closer alignment so that the organization can meet the challenges and opportunities posed by the environment (Pepettigrew and Whipp 1992).

The way organization works depends on competence, attitude and beliefs of managers and on the company structure (Finkelstein 2003). Undesirable effect on the enterprise management have following features.

A. Unreasonable complexity

1. Complicated and vague organization structure,
2. Too complex procedures for simple problems,
3. Too complicated, unclear or unconventional accounting,
4. Use complicated or nonstandard terminology.

B. Insufficient reflection over events in the enterprise

1. Management lack of experience in the enterprise development,
2. Managers neglect seemingly slight (but nontrivial) difficulties or details,
3. Managers ignore early symptoms of later problems,
4. The enterprise is fully satisfied of its strong position and does not consider means for maintaining it in the future,
5. Lack of analysis of reasons why some managers left the enterprise. This could be sign of hidden problems.
6. Exaggerated delight over a new product of the enterprise,
7. Premature euphoria caused by uniting with other enterprise,
8. Disappointment when overestimated expectations of the enterprises prosperity fail,
9. Disregarding unsuccessful undertaking which can be symptom of hidden problems to be solved.

4. Personal viewpoints of managers

It is of importance to understand the nature of the beliefs and assumptions of managers, and the cultural, social and political context in which they exist. It may help to distinguish between the intended strategy of managers – that which they say the organization will follow – and the realized strategy of an organization – that which it is actually following.

The way in which managers assess the need for strategic change is through an essentially qualitative assessment of signals which accumulate from inside and outside the organization. The definition of problems and choice of strategies by managers rely not so much on unbiased analysis of data as on perceptions of what powerful individuals in the organization see as the problem, and the manager's evaluation of the circumstances of the situation on basis of past experience and the own wisdom enclosed in the core assumptions and believes of the organization, i.e. in the paradigm. Despite of that, the value of analytical techniques is not to be underestimated. They contribute to wisdom of the organization and help in correction courses of action. The managers should possess a skill of useful combination of the rigor of analytical tools with their qualitative expertise to apply it to the process of management.

The first one who made observation and analysed of managers' behaviour in reality was Mintzberg (Mintzberg 1973; Mintzberg 1990). He divided the managerial work into three categories: (i) interpersonal relationship, (ii) information processing and (iii) decision making. Next, he identified four groups of characteristic roles the managers perform: external, related to internal function, individual, and situational. In an empirical study he revealed that in reality the managers are not thoughtful strategists carefully planning their firm's change but humans who are continuously interfered and disturbed (indeed, he found out that half of the managerial activities did not exceed nine minutes!). Mintzberg also observed that it is the organization, not individual capabilities, that determines a particular role, while influence of a manager's skill played a secondary role.

Table 2 Managerial roles. Source: (Mintzberg 1973)

Interpersonal	Informational	Decisional
Figurehead	Monitor	Entrepreneur
Leader	Disseminator	Disturbance handler
Liaison	Spokesperson	Negotiator
-----	-----	Resource allocator

Mintzberg's typology was important contribution and was proved in following studies of successors. The relationship between managerial behavior and organizational effectiveness was, however, left to future research.

4.1 Features of „unlucky” managers

According to many studies, i.e. (Finkelstein 2003), exceptionally unsuccessful decision makers have a number of common features:

1. They are sure that they do not have to react on changes of environment because their enterprise is strong enough.
2. They identify themselves with the enterprise so much that there is not clear distinction between their private matters and the enterprise business.
3. A manager who was permanently not satisfied by his work and position in a number of enterprises.
4. They have immediate and straightforward answers for all difficult problems.
5. They believe they are perfectly right and arbitrarily dismiss critics.
6. They are perfect enterprise spokesmen. Often substantial time spend for the enterprise publicity.
7. They consider very difficult challenges as temporary impediments that can be easily overcome.
8. They always go back to strategies and methods that were successful in the past.
9. Professional knowledge and skill of managers are not sufficient.
10. Manager's personal aims and the enterprise objectives are in conflict.
11. Managers are so greedy for profit and power that initiate too risky or unnecessary actions.
12. Aggressive and arrogant managers can cause loss of confidence of workers.

4.2 Other reasons of imperfect decisions

Some research, (Martino 1983) distinguish two categories of wrong decisions: (i) *Ignorance* and (ii) *Bias and prejudice*.

4.2.1 Ignorance

There are two kinds of the ignorance: (i) *Closed* and (ii) *Open*. Both can bring about significant forecasting errors.

Closed type of ignorance occurs when managers are not able or simply do not want to take cognizance of unexpected events. Such managers are convinced that they are able to exactly tell the future.

In case of **open ignorance** managers are aware of their limited knowledge and are ready to admit that. In this kind of ignorance one distinguishes four principal forms: **personal ignorance**, **group ignorance**, **ignorance of future** and **ignorance of complexity**.

Personal ignorance results from individual lack of knowledge or neglecting the problem. Its impact on the final decision can be reduced by considering various opinions of others.

The group ignorance can appear when decision is taken by a small team of persons who have similar views and opinions because of their age, education, and the like. Such groups can present common opinions and are reluctant to accept other views. It may result from lack of imagination. More about this subject is in Chapter 5.3.

It is unrealistic to predict exactly violent natural or social phenomenon like e.g. catastrophes of nature, crisis of natural resources or sudden technological or political changes. Therefore, **ignorance of future** occurrence of such kind of events is generally justified there are, however, computer games that can simulate alternative future events. These tools can help prepare preventive means.

Because of complexity of the world our knowledge of systems we live in can never be complete. Our world consists of many interactive natural, economical, marketing, social, and so on, systems. Identification of their interactions are extremely difficult and often impossible. Behaviour of these systems characterize following features (Committee on Forecasting 2010).

- (i) They often change – even stochastic – structures;
- (ii) The system's state is irreversible;
- (iii) Future states of the system is often unpredictable.

In these systems managers and other agents are numerous, various, and dynamic. They are mostly intelligent but imperfect decision makers. They try to learn from results of their activity and to adapt accordingly. They cooperate in groups often creating organizational structures for solving current problems. They work within environment that usually is dynamical and often chaotic. These facts give reasons for **ignorance of complexity** as the common phenomenon.

4.2.2 Bias and prejudice

Except of the ignorance biased attitude is also very unwished for the decision process, so managers should be aware how the bias can effect on the result. Prejudice is usually inherent attribute of the decision process participants and should not be considered as intentional. Although it is very important to recognize a participant's prejudice but it is difficult, often impossible task. However, there are two quite easy to recognize kinds of prejudice: age and the cultural background.

Prejudice related to age. Beliefs that future generations will be alike present ones are not true. The technologies that are not accepted today may be attractive in 10 or 20 years later. Present middle-aged generation is considerably different from parents and grandparents who had only paper books and stationary phones. Current developments of informatics and growing supremacy of visual communication means over written ones entail that schoolboys and students are often more acquainted with informatics tools than their parents. It follows from these facts that people's attitude depends on generation. According to many questionnaire surveys young are more than older people interested in the future. Seniors' views on days to come is limited and, consequently, present time is for them more important. Young are more interested in the future perspectives.

For that reason when looking for the distant future, for example after 5, 10 or 20 years, it is not good to rely only on opinions of authorities aged of fifty or more. Views of young will probably be more relevant.

Cultural and linguistic prejudice. It is commonly known that different social groups have different value systems, ethics, beliefs, etc. It has been proved, e.g. (Janis and Mann 1982), that cultural differences have an impact on perception, motivation, sensibility, and behaviour. That is why the consequences of these differences should be taken into account at data gathering and assessment, especially when opinions of the future are considered. It has also been proved importance of the way how language information is communicated. It has been noted that some respondents conformed their answers to the assumption of what they think is expected to hear. For that reason gathering information from people of different cultures it is necessary to remember of the respondents' language and living conditions.

Language of communication can affect the result of decision process. Some research have shown dependence of the questionnaire responses on the applied language. Other research revealed that answers respondents of two different languages were not identical. These observations suggest impact of type of language on decision quality.

There are researchers who maintain that – owing to globalization - the cultural differences among young people decline. For example, they say, Coca-Cola and jeans are popular also in Africa or Asia. Other researchers, however, claim that they are superficial symptoms only, because in reality affection to the traditions is even growing and this fosters tensions and conflicts among different cultures.

Events of the last decades does not seem to confirm the thesis of fading importance of the cultural differences. So, a caution is needed when taking into consideration views of people from other cultural sphere, even if they make an impression of entirely assimilated.

4.3 Incorrect decisions of teams

Opinion that teams take more fair decisions than individual persons is not always true. According to (Kozłowski and Piotrowski 2007) „A set of possible biases that may occur at group decision processes brings about scepticism about ability of teams to take rational decisions”.

Janis and Mann (Janis and Mann 1982) who studied dependence of the decision processes on group characteristics found following four main attributes of these groups:

1. Feeling of affiliation and loyalty for other members of the group. It results in conformity of opinions.
2. Impact of strong personality on other members of the group contributes to uniformity of opinions.
3. Acceptance of subjective evaluation criteria and reluctance to think of alternatives.
4. Underestimation of opinions from outside has stronger tendency in more integrated groups.

Inherent aspect of group work is striving the members for consensus. It demonstrates in damping other opinions and subconscious avoiding analysis pros and cons potential alternatives. This results in a number of problems during the future forecasting:

1. Groups have a tendency to take more risky decisions than individuals. Since responsibility of group decisions is shared between the members then group's attitude is more optimistic. It results in underestimation of hazard signals.
2. Groups have tendency to defend their underrating of warning signals. There are always able to find explanation why matters did not go as it was expected. Any criticisms from outside is rejected as unfounded. Typical group exhibits defending attitude against criticism, protects its members from outside impacts and argues that its decisions are correct.
3. Groups believe in ethics of their decisions. They tend to ignore ethical and moral consequences of results of their activities. These matters are not discussed at group meetings because it is assumed that all members possess these features.
4. Expectation of consensus results in exerting pressure on the members who have different opinions. The pressure can be direct or indirect and can cause isolation of members who have separate opinions or even exclude such a member from the group.
5. Members not sharing collective opinion often practise self-censorship. Views that not conform to obligating ones are usually expressed faintly in order to avoid unfriendly feelings of other members. Persons of separate opinions often do not believe in getting acceptance of others. This additionally contributes to self-censorship of individual concepts.
6. Leading group members are opposed to any information they think could be harmful for authority of the leader. Selection of undesirable information is also aimed at

separation it from members who could have other point of view and could destroy the group unanimity.

Negative effects of group work are very difficult to avoid. Existence of groups assures the members safety and sense of fellowship. The group defends against threats from the outside and maintains friendly cooperation of the members. To keep these circumstances the members have to avoid internal conflicts and support yourselves. But it limits ability of criticism and thorough analysis of alternatives. To prevent these drawbacks it is necessary to encourage presentation a variety of views and avoiding aggressive arguments. One can, for example, divide members into subgroups, each of different view, and tell them to convince others. It can also ask the members to find reasons against a specified decision. The group leader should not promote any specific view or answer by the time the group will elaborate its own position. It is also recommended to invite external experts.

5. Failures in development of products

This paragraph is devoted to a particular field of management. Companies that manufacture products for market have to cope with specific external and internal obstacles. Turbulent markets, chimerical clients, and strong competitors belong to external ones. Internal difficulties are caused by costs generated by inefficient organization of production lines and by products designed for too complex manufacturing.

5.1 Mistaken evaluation of market needs

It is difficult to invent a new competitive product. It should take into account technological and financial conditions of the company and should promise that market cost will be much higher than the cost of production. It should be the product which cost, including shopping and usage, will be – compared with the analogical products of competitors – attractive for clients in a longer time. The concept of such a product should be created by the interdisciplinary team.

Recognition of customer needs forms the base for all actions in product development. It is necessary to identify real customer preferences with regard to price, delivery and quality of the product. It is to remember that the user buying a product purchases, as a matter of fact, the service the product brings. For example, a dishwasher function is to wash up, a car is for transport etc. Thus, the ultimate goal must be not particular features or performance but satisfaction the user.

Developing products that are much better than users really need is risky. Clients may not be ready to pay more for the superb product properties because they are not familiar with them while the producer will suffer losses for the higher production cost. It is essential to identify buyers' actual priorities and to wait with further improvements till a moment the market will be ready to accept them.

According to Noriaki Kano (Kano 1996) the degree of client's satisfaction consists of three kinds of product or service features: *basic*, *functional*, and *distinguishing*. The basic are simply

these which a customer regards as evidently standard. If there is lack of a basic feature the customer feels very disappointed; if it is, however, ensured then the customer accept it as standard. For example, customers expect the clean bedclothes in hotels, TV sets equipped with user friendly remote controls, cars with effective wipers, and so on. These features do not contribute to competitiveness of the hotel or the TV set or the car but if they were not met in a satisfactory level the customer will be discontent.

Perfect recognizing and accomplishing of some basic features can be difficult. Sometimes they are not identified by the market research because they are regarded as obvious. They are, however, very important because they cannot be compensated by any other ones. That's why to make up a list of basic features needs experience and detailed monitoring of the market.

Functional features can be evaluated by means of appropriate criteria. There are, in principle, three categories of the criteria properties: the more-the-better, the less-the-better, and the closer to the defined value - the-better. Each criterion has its limit: the former two cannot change to infinity while the third can be achieved approximately only (usually it is enough if the deviation is sufficiently near the criterion). As an example of functional criteria can serve time of waiting to service in a bank or a car fuel consumption or the computer operating time without external feeding.

Functional features can be satisfied on the basic level and then they could be apparently like the basic ones. What makes the difference is that an improvement of a functional feature causes increasing of the customer satisfaction, while at the basic feature it does not happen. Market research can detect functional features as well as their level that the customers regard as satisfactory.

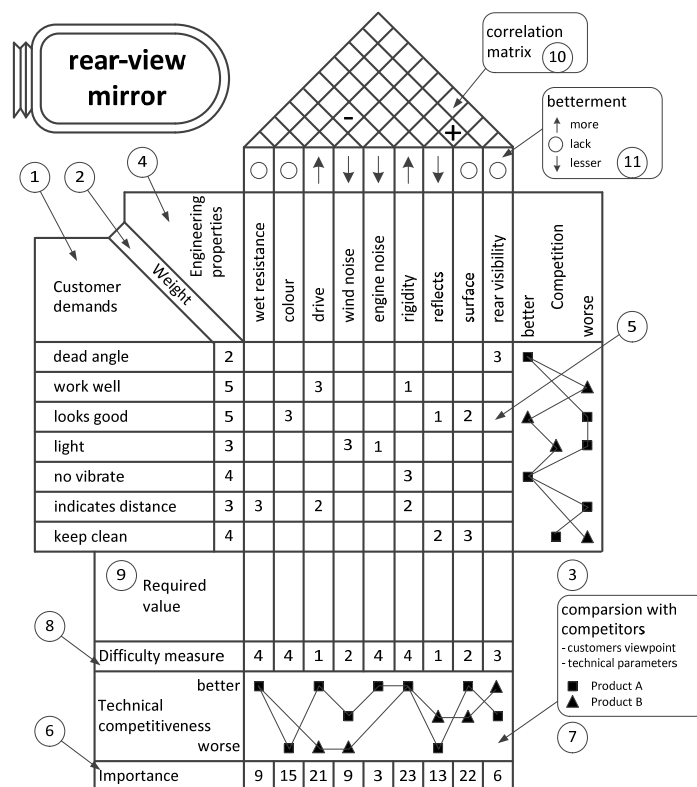


Figure 1. „House of Quality” of the QFD method (Clausing 1994).

A method which effectively helps to improve functional features is the *Quality Function Deployment* (QFD) (Clausing 1994). It converts customer demands into the technical (physical) features which are expressed in language of engineers. The method combined with Genrich Altshuller's TRIZ ('Theory of Inventive Problem Solving') – see for example (Altschuler 1984) - foster finding innovative solutions.

An example of converting user requirements into technical features for a rear-view car's mirror is shown in figure 1. In this example QFD consists of 11 steps. In the first two steps user requirements as well as their weights have to be determined. They are expressed in the user vocabulary. Level of complying the requirements by the own product and by that of competitors is evaluated in the third step. In the next step the producer puts product features that determine its technical quality. These features are expressed in terminology of the producer and should be measurable. The fifth step is especially important because it determines the relationships among user requirements and technical features. It results from information gained from various groups of people interested in the product: designers, manufacturers, salesmen, marketers, and potential clients. In step 6 importance of technical features is specified by multiplication weights of client requirements by the degree of their relationships with technical features. Step 7 compares the own product with competing ones. In contrast to step three this step requires technical data. Next step estimates degree of difficulty of technological realization. Quantification of technical parameters of the new product is determined in step 9 with taking into regard already evaluated competing achievements. In step 10 the 'Quality roof' is constructed. It has a form of the correlation matrix between individual technical features. Together with step 11 which indicates effects of change of technical properties, the last two steps create the basic information for the new, competitive product development.

Distinguishing features are those that a customer does not expect but if they appear he or she will admire them. For example, it can be a gift for a hotel guest at his name day or special bonus for the hundredth client of the travel agency. In this case market research is not particularly useful; more effective may be invention and inspection of unconventional ways of client attraction used by other companies. From economic reasons, however, the distinguishing features cannot be too expensive for the company.

It should be noted that feature categories and preferences of the customers change in time and may depend on localization. After some time a distinguishing feature can become a basic one. Similarly, a distinguishing feature in one country can be the basic only elsewhere. It is, therefore, necessary to keep up with changing preferences of the customers. Benchmarking can be of assistance, whilst reaction on complaints and critical remarks gives usually rise only to betterment of basic features. Discovering a distinguishing feature of the product or service needs much invention.

5.2 Avoiding faults increasing general costs of a company

Manufacturing constitutes the prevalent part of the product development costs. Consequently, possessing expensive production lines involves risk of the profit. In order to

return cost of investment, the machines have to be intensively exploited that can hamper production flexibility. Some hints for reduction general expenses are addressed below.

1. Production areas should be easy adapted to various production processes. Because needs and preferences of clients often change, the products have to change, too. It follows that there is necessary to reorganize lay out of the production cells, equipment, material routes, inventory location and so on. Because all these changes have to be prepared before the new production start so it is important to do it without difficulty.

2. Manipulation processes should be simple because they need space, involve hand work, and sometimes also expensive tools. Chucks, grips, cable hooks, and other hand tools which will be used to shift the equipment have to be arranged beforehand. Displacement of heavy objects should be easy. Large sized and awkward structures should consists of modules. Container constructions should eliminate jamming or hooking contained elements. Dangerous materials need satisfy special requirements.

3. Stocks of materials and parts waiting for processing should be as small as possible because maintaining of the factory stocks can incur remarkably part of the production costs. An effective solution is inventory management in accordance with Just-in-Time (JIT) system (Ohno 1988; Licker 2003). Effective implementation of JIT principles need to be taken into consideration during design of production processes. At that moment there is a good opportunity to find suppliers which are able to deliver materials without delay and with little batches.

4. There are also supplementary materials consumed in manufacturing that can be expensive. Various lubricants, grinding materials, glues, paints, finishing supplements, and the like, are a few of examples. These expenses are particularly remarkable in case of new products which require much supplementary materials. Their cost have to be considered early in the production planning and designing.

5. Measurement and controlling operations do not contribute directly to the product value although they cost. To reduce them it is necessary to design products of little control demands. It can be accomplished by implementation of Six-Sigma principles combined with techniques of Statistical Process Control (Phadke 1989) and Design for Testability (DFT), (Booker at al 2001; Kusiak 1993).

6. Maintenance of the equipment and keeping them ready-for-use engage remarkable general costs and require specially trained personnel. At turbulent market a long time is necessary to accomplish a profit. Investment in expensive production machines is justified if the market is stable and production process entirely under control. Outsourcing of expensive operations is also worth of considering.

7. Automation of production should be implemented only after thorough analysis pros and cons. There are companies that are absolutely convinced of profits derived from automation and make great investments for modern production machines. They expect it is the way to decrease the labor costs and to increase profits. In reality, however, capital investment charges every product and decreases disposable fund of the company. If automation is

thought for one new product only then evaluation of profitability is easy but if new automatic machines have to produce various products, justification is more difficult. Thus, automation should be applied on basis of sound arguments only (Mascitelli 2004).

8. It should be taken into account that capacities of new production tools are compatible with the rest of the production line. Installation of a machine of much more production power than others can cause obstructions in production flow, necessity of storage of items waiting for further processing and the like. Such investment will not cause profit but troubles.

9. Capital expenditure should be aimed at the basic production processes, but not for a particular product type only. Occasional processes should be located outside.

5.3 Errors in design for product manufacturing

Disregarding during design features important for the product manufacturing can later be troublesome or even impossible to amend. To prevent this concurrent engineering methodology has been developed. Detailed recommendations concerning difficult operations of processing and assembling can be learned from advanced books on DFMA (Design for Manufacture and Assembly) (Boothroyd et al 1994; Whitney 2004). Implementation of these guidelines in the design contributes to shorten production cycle.

Any engineer in the design team should remember the following recommendations.

1. It is recommended to take all benefits from experience gained in the previous design and manufacture processes.

2. From the manufacturing points of view the designed product structure should be rationally simple. Low manufacturing cost should be the general objective of every design team. The method of value analysis helps to reduce a number of parts and to lower the cost (Miles 1972).

3. The company should manufacture only things which cannot be purchased from suppliers at lower price. The well-known question: *Make or buy?* should be answered at the early stage of the conceptual design.

4. Avoid operations that need workers of the highest qualifications, since labor costs depend on the personnel skill. A product designed for easy machining and simple assembling is relatively cheap (Rohatynski and Sęsiadek 2014).

5. Products with elements that need long production times, complicated assembly or longer storage in unfinished conditions should be avoided.

6. Summary

The paper is based on theory and methodology of management with particular emphasis on managers' role in making decisions that are important for reactive or proactive actions necessary in changing environment. It contributes to the theory and practice of management. Managers' decisions are specific and have great impact on function of the enterprise. Therefore, it is of importance to understand the nature of the beliefs and attitudes of

managers, and the role of type of environment in which they work. It may help understand why they commit incorrect decisions when face serious problems. That is why recognition of causes that can contribute to wrong decisions in solving managerial problems is the main theme of the paper.

The paper describes the subjects in following order: (i) general faults of management process caused by environment of managers; (ii) personal shortcomings of managers' knowledge, ability and attitude; (iii) improper evaluation of market needs and company's resources; and finally (iv) faults in product design, production planning, and organization of manufacture. Ways of these faults avoiding have also been suggested.

Despite there is still much room left for further research, the author believes that the information presented in the paper will be useful for managers, practising engineers on medium and top positions, and for students.

References

- Ackoff, R.L. (1979), *The Art of Problem Solving*, p.26, J. Wiley & Sons, New York.
- Ackoff, R.L. (1993), *Zarządzanie w małych dawkach*, p.130, PWN, Warszawa.
- Altschuler, G.,S. (1984), *Erfinden. Wege zur Lösung technischer Probleme*, VEB Verlag, Berlin.
- Bolesta-Kukułka, K. (2003), *Decyzje menedżerskie*, p.44-45, PWE, Warszawa.
- Booker, J.D., Raines, M., Swift K.G. (2001), *Designing Capable and Reliable Products*, Butterworth-Heinemann, Oxford.
- Boothroyd, G., Dewhurst, P., Knight, W. (1994), *Product Design for Manufacture and Assembly*, Marcel Dekker, New York.
- Clausing, D. (1994), *Total Quality Development*, ASME Press, New York.
- Committee on Forecasting Future Disruptive Technologies (2010), *Persistent forecasting of disruptive technologies*, The National Academies Press, Washington, D.C.
- Finkelstein, S. (2003), *Why smart executives fail*, p. 242, Penguin Group, USA.
- Griffin, R.W. (2004), *Podstawy zarządzania organizacjami*, p.7, PWN, Warszawa.
- Harrison, F.E. (1997), *The Managerial Decision Making Process*, p.6ff, Houghton Mifflin Company, Boston.
- Janis I.L., Mann I. (1982), *Decision making: A psychological Analysis of Conflict, Choice and Commitment*, Free Press, New York.
- Kano, N. (1996), *Guide to TQM in Service Industries*, Asian Productivity Industries, Tokyo.
- Koźmiński, A.K. Piotrowski W. (reds.), (2007), *Zarządzanie. Teoria I Praktyka*, p. 102, PWN, Warszawa.
- Kusiak, A. (red.) (1993), *Concurrent Engineering. Automation, Tools, and Techniques*, J. Wiley, New York.
- Licker, J. K. (2003), *The Toyota Way: 14 Management Principles*, Mc Graw-Hill, New York.
- Martino J.P. (1983), *Technological Forecasting for Decision Making*, North Holland, New York.
- Mascitelli, R. (2004), *The Lean Design Guidebook*, Technology Perspectives, Northridge, CA.

- Miles, L. D. (1972), *Techniques of Value Analysis and Engineering*, McGraw-Hill, New York.
- Mintzberg, H. (1973), *The Nature of Managerial Work*, Harper&Row, NY.
- Mintzberg, H. (1990), *The Managers Job – Folklore and Fact*, Harvard Business Review, Boston.
- Morgan, G. (1986), *Images of Organizations*, SAGE Publications, London.
- Nadler, G. (1979), *Projektowanie procesów pracy*, Prakseologia, NR 2 (70)
- Nadler, G., Hibino, S. (1989), *Breakthrough Thinking*, Prima Publishing & Communications, Rocklin.
- Ohno, G. (1988), *Toyota Production System. Beyond Large-Scale Production*, Cambridge, MA.
- Penc J. (1997), *Leksykon biznesu*, Placet, Warszawa.
- Phadke, M. S. (1989), *Quality Engineering Using Robust Design*, Prentice Hall, New York.
- Pepettigrew, A., Whipp, R. (1992), *Managing Change for Competitive Success*, Basil Blackwell, London.
- Robbins S.P., Coulter, M. (2012), *Management*, p.5, Prentice Hall, New Jersey.
- Rohatyński R., Sąsiadek, M. (2014), *Design for Disassembly and Reverse Logistics – a New Challenge for Concurrent Engineering*, Proc. of International Conference TMCE'2014, p. 1627 – 1634, Budapest.
- Simon, H. A. (1982), *Podejmowanie decyzji kierowniczych*, PWE Warszawa.
- Urban, G. L., John R. Hauser (1993), *Design and Marketing of New Products*. 2nd ed. p.19, Englewood Cliffs, Prentice-Hall.
- Volberda, H. W. (1998), *Building the Flexible Firm. How to Become Competitive*, Oxford University Press, NY.
- Whitney, D.E. (2004), *Mechanical Assemblies*, Oxford University Press, New York.
- Wyrwicka M. (2006), *Proaktywność jako przesłanka inteligencji organizacji*, w: Organizacja Inteligentna, Perspektywa zasobów ludzkich, p.31-43, (red.) C. Suszyński i G. Leśniak-Łebkowska, Oficyna Wydawnicza SGH, Warszawa 2006.

Team roles and styles of factual and relation communication and social interaction

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Abstract: The aim of the paper is to analyse the relations, influences of team roles, styles of factual and relation communication, and social interaction of the employees IT department. For the basic and applied research, a quantitative survey design was used three types of questionnaires – Belbin team role inventory and the rating list, ECR-CZ (Experiences in Close Relationships), and the questionnaire of out-group communication assessment. There were eight gender-balanced teams of 53 participants in the sample. The choice of participants was targeted. The average age of the participants was 39, ranging from 22 to 50. Organizations have recently been forced to adapt quickly to the increasing demands and conditions of the global market. A possible way to succeed in a rapidly changing turbulent environment is to respond flexibly to business opportunities and opportunities for both cross-border and foreign intercultural cooperation, mutual co-ordination, partnership, teamwork, communication and sharing of information and communication using digital- technologies and social networks. An essential prerequisite for achieving the performance, success and synergy of the team is its knowledge and ability to negotiate, argue, persuade, teamwork. It is necessary to be empathic, assertive, and also to be able to deal with conflicts. The attachment theory as interpreted by John Bolwby is a possible way to analyse interpersonal relations in people-to-people contacts. Based on Bolwby's knowledge and experience, it is possible assess and evaluate the relationship perception, and behaviour of the individual. In a deeper context, it allows understanding the relationships, influences and styles of communication between teams. The authors of the paper found a positive relation between a team role of a Specialist and a dimension of attachment-related avoidance. On the other hand, there was a negative relation between a team-role of a Resource Investigator and attachment-related avoidance. Heterogeneous teams reported a better rating in out-group communication. The interrelations and relations between the rating achieved in the mutual communication and the team balance regarding the team roles were found in three questions on sharing of necessary information, open communication and willingness to understand others. The aim

of the paper was to understand the style of factual and relation communication, and social interaction of IT technicians in order to find appropriate, efficient and functional attachment and people-to-people contact and connection of team roles through open communication in the process of interaction. The results as found out by the authors call for possible use of attachment through communication and social interaction among the sample IT technicians.

Keywords: Team roles, styles of factual and relation communication, social interaction, working team

1 Introduction

Organizations have recently been forced to adapt quickly to the rising demands of the global market (Holátová and Březinová 2013). One way to succeed in a rapidly changing environment is using teams and team roles. For most things in life, the range between the best and the average is about thirty percent. The best food, the best plane flight can be thirty percent better than the average. The Mac team was an attempt to assemble a team from only the best players. People say that they cannot get on well with each other that they will not be able to cooperate. But I found that the best players have no problem working with other best players, but they cannot work with worse players (Isaacson 2011, p. 438-439). Building or shaping roles is a continuous process that involves not only managers, but above all the leading teams and people who come under them. It means achieving agreement on defining obligatory and responsibilities, goals and skill requirements that can change. Role will be shaped as people will develop in them that they will respond to opportunities and changing demands, they will acquire new skills and will develop their skills and competence. This process can occur in the context of work performance management where the regularly updated work performance agreement sets out the key results and capabilities needed to achieve them. It is essential to ensure that managers, team leaders and workers acquire the necessary skills to define roles in the process of managing work performance. Human and personal roles should be represented in a team in a harmonious state, the occupation of which is desirable for the functionality of the team and key to the demanding work. A well-functioning team is characterized by the optimal fulfilment of given tasks according to the set time in accordance with the given objectives and a balanced diversified functional dynamic structure. A key condition for achieving a team's success is the ability to negotiate and find own ways of meeting given goals (Caha 2017). Effective teamwork is based on interaction between individuals and groups/teams to provide resources, understanding and meeting requirements for performance, coordinating activities with other teams. One of the ways to look at interpersonal relationships is the theory of relationship bond (Bolwbyho 2010). This theory provides insight into the field of relationship perception and human behaviour in society, providing a basis for a deeper understanding of the behaviour of individuals in the work environment. Concurrently with theory of relationship bond, it offers possible alternatives to individual behaviour in interaction with other members of society, as well as

team roles theory that point to the behaviour and conduct of team members in a team environment.

2 Aim and processing methodology

The aim of this paper was to find out the relationships, influences of team roles and styles of factual and relationship communication and social interaction among selected teams of IT department staff. For the purpose of basic and applied research, quantitative research design was used in the form of a questionnaire survey using three types of questionnaires, i.e. Belbin's self-assessing inventory of team roles and the List of evaluator, further questionnaire ECR-CZ (Experiences in Close Relationships), but also a questionnaire for the evaluation of intermediate communication. The sample was comprised of 8 gender-balanced teams with a total of 53 respondents. The selection of respondents was targeted. The average age of respondents was 39, the age range ranging from 22 to 50 years. The submitted contribution aimed at understanding the style of factual and relationship communication and social interaction in the environment of the employees of the IT department in order to find suitable, effective and functional relationships bond and interpersonal contacts and the joining of the team roles through open communication in the process of mutual interaction of individuals.

For the practical demarcation of the research problem, the main research objectives were set:

1. ascertain the connection between team roles and the style of relationship bond to the sample of selected IT teams in the addressed company,
2. explore the connection between the balance of the composition of the individual teams from the point of view of the team roles and style of relationship bond of the selected sample of respondents,
3. identify the connection between the assessment of team intermediate communication and the IT structure.

Furthermore, partial research goals were formed:

1. define the aggregate sample and individual teams in terms of the relationship bond style,
2. describe individual teams in terms of representation of the team roles of individual team members,
3. characterize the individual teams with respect to the team composition of the balance of team roles and the style of relationship bond.

The following hypotheses were formulated in order to achieve the set objectives:

H1a: There is a significant positive correlation between the percentile of the team's Specialist role and scale of relationship avoidance of the Effective Consumer Response (ECR).

Characteristic for the Specialist role is pride in work and the possibility of self-management of work activities (Belbin 2010), with the fact that individuals are not too willing to perceive and solve problems of others (Bělohávek 2008). These characteristics could correspond to the

evasive style of relationship bond for the tendency to act independently, stay aloof from the group (Smith, Polglase and Parry 2012, p. 585-601).

H1b: There is a significant negative correlation between the percentile of the team's Resource searcher role and scale of relationship anxiety of the Effective Consumer Response (ECR).

H1c: There is a significant negative correlation between the percentile of the team's Resource searcher role and scale of relationship avoidance of the Effective Consumer Response (ECR).

Resource searcher is a sociable, tolerant, communicative extrovert, able to simply establish relationships with other people (Bělohlávek 2008). This role could be appropriate for a certain style of bond, characterized by the ability to develop and keep social skills (Guererro and Jones 2005).

H1d: There is a significant positive correlation between the percentile of the team's Monitor/Evaluator role and scale of relationship anxiety of the Effective Consumer Response (ECR).

The Monitor/Evaluator manifests indecisively and must be encouraged and supported within teamwork. He is conscientious, hinders the team from risk and rash decision (Bělohlávek 2008). This team role may be related to relationship anxiety. Anxiety individuals are looking for another source of help and safety, and their efforts are increased in the case of respect (Boccatto and Capozza 2011, p. 19-30).

H1e: There is a significant positive correlation between the percentile of the team's Rectifier role and scale of relationship avoidance of the Effective Consumer Response (ECR).

The Rectifiers tend to conflict, are associated with an authoritative style of management and task orientation. They do not afraid of the obstacles or reluctance of others (Bělohlávek 2008). The role of the Rectifier may be related to the evasive bond style in terms of the need for a high level of performance, criticality, and focus on completing the task (Ein-Dor, Mikulincer, Doron and Shaver 2010, p. 123-141).

H1f: There is a significant negative correlation between the percentile of the team's Team worker role and scale of relationship anxiety of the Effective Consumer Response (ECR).

The Team worker prefers good relations between people and well-being. They are finding mistakes more likely in own person, on others they see positive aspects (Bělohlávek 2008). Linking can be tied to the anxious style of a team role that evaluates individuals as less effective, focused on building close relationships with other people (Rom and Mikulincer 2003, p. 1220-1235).

H1h: There is a significant positive correlation between the percentile of the team's Finisher role and scale of relationship avoidance of the Effective Consumer Response (ECR).

The Finisher is anxious, thorough, precise, focused on detail (Belbin 2010). The related style of relationship bond could be evasive for the emphasis on detail along with analytical, detail-oriented thinking (Mikulincer and Shaver 2007).

H1i: There is a significant positive correlation between the percentile of the team's Coordinator role and scale of relationship avoidance of the Effective Consumer Response (ECR).

The coordinator has a leading role, characterized by flexibility, a democratic approach. It may be related to a certain relationship bond (Bělohávek 2008). Significant individuals have a stronger prerequisite for coordination and leadership (Mikulincer, Doron and Shaver 2010, pp. 123-141), are emotionally stable, calm and balanced even in the case of a risk.

For the team roles of the Innovator and Realizer the authors of the paper defined two-way hypotheses:

H1j: There is a significant correlation between the percentile of the team's Innovator role and scale of relationship anxiety of the Effective Consumer Response (ECR).

H1k: There is a significant correlation between the percentile of the team's Innovator role and scale of relationship avoidance of the Effective Consumer Response (ECR).

H1l: There is a significant correlation between the percentile of the team's Realizer role and scale of relationship anxiety of the Effective Consumer Response (ECR).

H1m: There is a significant correlation between the percentile of the team's Realizer role and scale of relationship avoidance of the Effective Consumer Response (ECR).

H2a: There is a significant negative correlation between achieved concordance of self-image and evaluation of observers of the Interplace Team Role Instrument questionnaire and relationship anxiety.

H2b: There is a significant negative correlation between achieved concordance of self-image and evaluation of observers of the Interplace Team Role Instrument questionnaire and relationship evasiveness.

H3: The more balanced the team is from the point of view of the team roles, the less homogeneous is the composition of the team from the point of view of representation of the style of relationship bond.

Given set aims of research quantitative design was defined in the form of a questionnaire survey. In the case of a quantitative survey, we are based on the positivist paradigm, i.e. from the assumption that „there is one objective reality that is not dependent on our feelings or persuasion“ (Gavora 2008, p. 36), which can be measured and explained in scientific terms.

In the case of a conducted survey the authors of the paper used 3 types of questionnaires:

Team roles were found based on Czech version of the Interplace program: Interplace Team Role Instrument, which calculates a team role score based on the self-image inventory (Belbin's Team Role Self-Perception Inventory; BTRSPI) and an adjective selected by at least four observers in the observer assessment sheet (Observer Assessment, OA).

Belbin's self-image inventory of team roles contains 70 items divided into seven sections. Each respondent assigns ten points in the section that best represent his social behaviour. Nine

items characterize the behaviour of one type of team role; the tenth question is determined by the relationship of social suitability. In calculating team roles, scores are not included in social desirability items, which partially remove the impassive nature of the tool (Dierendonck & Groen 2011, p. 345-366).

The observer assessment sheet consists of a list of 81 adjectives divided into two parts. The first part contains 57 unipolar positive adjectives; the second part consists of 24 unipolar negative adjectives. Each observer assigns 1 point for adjectives that apposite characterize the evaluated individual. A value of 2 points can be given by the observer in case of significant suitability, e.g. adjectives for the Team worker role (tactile, willing).

The use of these tools as a useful predictive diagnostic means is confirmed by research of authors Parington and Harris (1999), Senior (1997, p. 201-258), Pisani (2012, p. 411-430). Dierendonck and Groen (2011) in their study point out the optimal discriminatory and convergent validity of the tool as a whole in relation to a low negative correlation between the number of observers and the concordance/consistency of the observer ratings.

Relationship bond style. The electronic version of the Czech scale Experience in Close Relationships (ECR-CZ), created in the original version by Brennan, Clark and Shaver (1998, p. 46-76), was used to find out the relationship bond style. The ECR (Effective Consumer Response) contains two scales, i.e. relationship anxiety and relationship avoidance, with each scale consisting of 18 items. The seven-point scale of the Likert scale (1 - I strongly disagree to 7 - I strongly agree) was used to evaluate the relationship bond. Authors Lečbych and Pospíšiliková (2012) found the high internal consistency of the individual items of the Czech version of ECR in both scales. To determine the predominant relationship bond style, standards for each dimension were used separately. A secure relationship bond style was attributed to a respondent who achieves a T-score for both scales at a point value of 60 or less. Respondents with an uncertain relationship bond style reached T-score values for one of the dimensions higher than 60 (Seitl, Charvát and Léčbych, Psychometric characteristics of the Czech version of the Experiences in Close Relationships (ECR), unpublished). Part of this method was to complete the stratification questionnaire.

Inter team communication. In order to assess the satisfaction with inter team communication, the authors of the paper decided to use the questionnaire of their own construction according to Dvořáčková (2017), which included 5 claims:

1. In terms of mutual cooperation, they express expectations with a view to the future so that cooperation is successful. Further define goals including prediction of results, deadlines, procedures, etc. of the company's necessary requirements.
2. They share the necessary information that is necessary in fulfilment the current task in relation to the assigned goal. By achieving its own goals, it supports the fulfilment of the expected goals, including sharing information, transferring resources, or using other means of mutual support for effective social action (Janoušek 2015).
3. In mutual communication they openly express own opinions and thoughts. Open communication means that individuals/employees are willing to exchange their thoughts and ideas even if these ideas are not in compliance with the general public

opinion. Employees are more likely to be hesitating in involvement in the support process of achievement of the organization's goals if they cannot trust their superiors or if there is no open mutual communication (Thomas 2009, p. 287-310).

4. In common problem solving, they are actively interested in the views of other team members. The willingness to understand other people, to understand their actions, intentions, ideas and needs forms the basis of communication behaviour (Plamínek 2012).
5. They trust the information they receive. Williams (2001, p. 379) states that „trust develops through repeated social interactions that allow people to update their information on the trustworthiness of others“. Members of the organization must trust their information sources. People quickly discard those information sources that have proven unreliable and untrue. If we perceive information as accurate and correct, we trust them more and synergistically use their content. Thomas (2009, p. 287-310) further found that information quality is an important factor in the communication process with co-workers and superiors.

For each of the above statements, a ranking of the teams from the 1st to the 8th place was compiled, according to the set criteria that best qualified them. Furthermore, the distance between each order was determined on the 10-degree scale (1 marked the minimum difference, 10 the extreme difference).

The questionnaire was taken over by Dvořáčková (2017) and created in Microsoft Office Excel 2010 and placed in a shared space so that ensure the anonymity of the respondents. Each participant received an email with instructions to fill out the questionnaires and a hypertext to the placement of the questionnaires. At the beginning of the questionnaire, respondents were briefed inform about the purpose of the survey and about the preservation of anonymity of addressed.

3.1 Basic and sample set

The basic set was made up of staff of IT Company from the state administration. The record number of employees as at 31 December 2017 was 162 employees. The sample set comprised a total of 8 teams with a total number of N = 53 respondents (32 % of the basic set). Into sample set was included teams involved in the implementation of new information systems in the state administration, as the functional interaction of these teams, including effective communication, is an important prerequisite for successful implementation.

3.2 The course of research

The sample set was created by deliberate selection. According to Urbánek (2011), the deliberate selection is based on the judgment of the researcher, which requires knowledge of the characteristics of the population and is to a certain extent based on the subjective decision about the significance of the characters which is needed to take into account. In our case, the author of the paper used personal knowledge of the basic population. Data collection of all three used methods took place between September and October 2017 through the on-line computer interface.

In compliance with the right to information, each respondent was informed about the goals and meaning of the survey. For the purpose of evaluating inter team communication, it was necessary to publish the names of individual respondents in the questionnaire according to the order of the evaluated teams. Each respondent decided whether or not to participate in the survey, while ensuring the credibility of the found information. The respondent who decided to participate in the survey signed a written consent to the provision of personal data for research purposes, where he agreed with the alternative at any time to withdraw from research at his own request. The obtained data was anonymous and was processed in such a way that it was not possible to identify in the summary results the links with specific addressed respondents. At the same time, there were respected the wishes of the analyzed company in which the survey was carried out, not to mention its name, including further identification of the data.

4. Data analysis method

The input data was anonymous for quantitative processing purposes. For processing data there were used Microsoft Office Excel 2010, Statistics 12 and outputs form E-Interplace were processed for individual respondents and participating teams. Data analysis was carried out using descriptive and inferential statistics. Spearman correlation, Mann-Whitney U test and McNemar chi-square test were used to evaluate the results. All hypotheses have been tested on meaningful levels $\alpha = 0,05$.

To assess team balance by identifying the representation of team roles in each team, the author of the contribution decided to use two methods. As state van de Water et al. (2006), there are many methods used to determine team balance, which are based on the assertion that for each team role it is possible to reach a maximum score of 100 points:

1. method applied in Senior research (1997, p. 201-258). Two measures were used to determine the team's balance so that the team was considered balanced according to the representation parameter. The first level for determining team balance (KA1) was judged by team roles for individual members, i.e. whether a score of 70 or more was achieved for individual team roles. If there were nine team roles with a value greater than 70, the first team balancing condition was met. The second measure (KA2) was the average team score for each team role, which should not achieve mutual higher variability between individual roles (value above 20 %). The indicator 20 % arbitrarily determined Senior (1997, p. 248) on the grounds of a conceptual and theoretical opinion. Van de Water et al. (2006, p. 5) did not use the percentage representation to calculate the second condition, but the point value identically as the author of the contribution. To meet the second condition, it was essential that the average number of points for all team members within the team roles varied between the minimum and maximum points value.
2. method used in the study of authors Smith, Polglas, & Parry (2012, p. 585-601), which is inspired by the results of method of authors Partington and Harris (1999, p. 694-

705). To determine the balance of each teams the authors used the calculation of individual criterion:

- a. KB1: distribution of a strong example of a team role based on the calculation of the point value measured for the team role for individual member of the team. The mathematical formula was used to calculate the point value:

$$KB = 100 \frac{r}{B}$$

$KB1 = 100 r B$, where r is the sum of the number of significantly represented by team roles in a given team (an important role is a role with a score of 80 or more); in the case of a significantly represented role, we count for a given team role 1, in the case of a missing role we count 0; B is the total number of Belbin team roles (in the case of the realized survey, the value of 9 was achieved, according to Belbin 2012).

- b. KB2: duplication of roles. Based on Belbina (2012), it was found that in addition to the role of the Team worker and the Realizer, no other roles should be duplicated. The KB2 criterion was defined subsequently:

$$KB2 = 100 \frac{(n - 1) - d}{(n - 1)}$$

d is the total number of significant representation of each team role in the given team, n is the number of team members.

For appraisal of team heterogeneity or homogeneity in integrating the relationship bond style the contribution authors used the team role method modified to use the obtained data from the ECR-CZ questionnaire. To determine the homogeneity/heterogeneity of the team in integrating the relationship bond style, a measure (EA1) was used to occupy individual relationship bond styles based on achieved T-score scale of anxiety and avoidance with a score of 60 or more. The second measure (EA2) was measured the average team score separated for the subdivision anxiety and avoidance, which should not achieve a mutual higher percentile variability between each sub-scale at a percentage higher than 20 %. Two criteria were used to determine team homogeneity/heterogeneity:

1. EB1: distribution of the use of an example of a relationship bond style based on the T-score calculation defined for each relationship bond style at individual members of the professional team:

$$EB1 = 100 \frac{r}{B}$$

r is the number of represented styles of relationship bond in the given team, B is the total number of possible styles of relational bond (in the realized survey value 3).

2. EB2: duplication of styles. An equivalent rule was used for team roles in which individuals achieved T-score values in the dimension of avoidance or anxiety with a

value higher than 60 and more, the representation of which was only one time. EB2 was defined:

$$KB2 = 100 \frac{(n - 1) - d}{(n - 1)}$$

d is the total number of occupation of each relationship bond style in the team, n is the number of members in the team.

For the evaluation of the achieved ranking of the team, the calculation of the median order was used, in which each respondent evaluated the ranking of the team from 1. (the best) to 6th (the worst), including the distance between the individual orders. The team in first place was evaluated 1 and each other team received a score of 1 plus a distance to the next ranked position in the decimal number. E.g. team A placed in 1st place, team B placed in 2nd place and distance between placements was evaluated by number 5, team C placed in 3rd place, distance between team B and C was evaluated by number 1. Incorporated the result for team A was 1, team B 1.5 and team C 1.6. The final ranking of the teams according to the individual questions included in the survey was ranked according to achieved median results.

Out of a total of 60 respondents, Interplace Team Role Instrument questionnaire filled in 53 responds. The ECR-CZ questionnaire was not filled by 3 participants and another 4 respondents were not included in the processing of results because of discrepancies between the filled-in data in the stratification questionnaire and the ECR-CZ questionnaire. The questionnaire inter team communication was completed by 42 respondents, and all completed questionnaires were included in the overall processing and evaluation of the results.

5 Results and discussions

5.1 Partial Research Objective 1

In the structure of the sample according to the style of the relationship bond, the high score was achieved by the share of the style ($n = 31$, 52 %). Uncertainty style of evasive with value ($n = 6$, 14 %) and uncertain style of anxiety with value ($n = 7$, 18 %), the uncertain style of disorganized relationship bond has reached a percentage score of 0 %. The authors analyzed the gender structure of relationship bond style according to the gender, in the male sample of the population a certain style of relationship bond was represented (81 %), while the avoidance style represented only 12 % and the anxiety style of the relationship bond was 7 %.U the female population certain relationship bond style was identified in a high score (65 %), compared with a male group, there was a higher representation in anxiety style of relationship bond that is in proportional value 24 %, compared to 7 % in males, and share of the avoidance style reached a similar value as men, i.e. 11 %.

Six teams (II, III, IV, V, VI, VIII) gained a higher percentage representation of individual team members with a certain style of relationship bond in comparison with the average value of the sample set, when team IV had a 100 % representation. Individuals with a certain style of

relationship bond had social skills including cooperative skills and adaptive stress management. These characteristics were in team assessed as favourable due to frequent mutual work with customers/clients. In team VIII, were in higher number represented members with avoidance styles of relationship bond (68 %). Team III formed members in leading positions (n = 6, 27 %). Compared to team VIII, the overall proportion of anxiety (35%) was higher, of which 27 % were senior executives. For the three teams (II, IV, VI), the anxiety style of the relationship bond did not occur.

The comparison of relationship bond styles and average age in individual teams showed the average lower age of a certain style (36) compared to the uncertain style (avoidance 41 and anxiety 45). Authors Seitzl et al. (unpublished) found a statistically significant dependence of the scale of avoidance and anxiety in relation to age, in the scale of relational anxiety that decreases slightly with age and the relational avoidance that increases with age, especially among men.

5.2 Partial Research Objective 2

In identifying the description of individual team the authors of paper work with overall partial reports of the team with a focus on the results obtained from the Interlace Team Role Instrument.

Team I. The team, who's most important roles were the Innovator, Coordinator and Team worker, had an extensive source of thoughts and ideas. Problems were identified in the initial phase due to the absence of the Rectifier role in relation to the high number of represented members. Team leader focused on developing personal mutual relationships between individual team members. The team could use a member of the Monitor/Evaluator position to determine plans or solving of complex problems caused by the absence of a Specialist role. In the sense of implementation of the plans into practice, the role of an effective coordinator has been used, who has ensured the adequate involvement of all participating members and the Realizer, who has prepared practical working procedures. Based on the findings, both of these team roles were not identified in the survey.

Team II. The team is most represented by the Resource searcher role, characterized by openness to the environment and the ability to establish external contacts. The role of the Specialist and the Coordinator was also significant. Team risk was recognized in the different approaches and behaviours of individual team members, especially at the friendly level between Source searchers and Specialists. Leaders in the role of Rectifier/Finisher profiled in order to meet goal and achieve the expected results that complete the weaknesses of the Resource seacher and Team worker role. Like teams I and VI, they may get into problems in the final stages of the projects due to the absence of the Realizer.

Team III. The team achieves the highest average score for the Innovator and Specialist position, as well as the Monitor/Evaluator. By connection of expertise with creative approach, it is suitable for the development of innovation. A supervisor's connection in the role of the Monitor/Evaluator with the Innovator is functional provided that the Monitor/Evaluator is not too critical to Innovator's ideas and will respect the analytical and strategic approach of the Monitor/Evaluator. Risks to meeting goals may hinder the absence of a Team worker role,

which can increase team morale and facilitate mutual communication. This team may be inconsistent with completing the assignment due to the absence of Realizer members and Finisher.

Team IV. The team is characterized by the absence of the controlling role of the Rectifier, Coordinator and Innovator, which may be negative, for example in situations of long staying in one place, delaying important decision-makings or inadequate participation of all team members in partial strategic and conceptual decisions. The highest representations have team roles Finisher, Monitor/Evaluator and Realizer. This combination ensures that the team will carry out all the activities consistently and will strive for its perfect execution. The strengths of this team will be shown in the long run. The most frightening weakness of this team is the initial phase of the assignment and implementation of team activities in which targets are set due to the absence of both key roles. The absence of an Innovator with creative thinking and innovation capacity is an unfavourable factor affecting the strategic decision-making phase. At this stage are the key skills and opportunities to advance the views and ideas of Resource search are priority.

Team VI. Team workers collaboration along with Resource seacher is embedded in an equal relationship that appeals to members' willingness to keep a good team atmosphere with the possibility of sharing their share in solving emerging issues and emergencies. The weakness of this team is the low representation of the role of Monitor/Evaluator, whose priority is an analytical approach to thinking and decision making, including the ability to critically assess proposed variants of possible solutions. The priority of the team is the role of the Coordinator/Specialist who is respected as a carrier of expertise and key ideas and partial solutions formulated for the purpose of setting target.

Team VI. As for Team I, this is a group with a high representation of Innovator team role. Subsequently the roles of team worker and finisher are identified. This team needs a person who will be strong enough to coordinate team effort and drive towards the set goals. As a team I can feel the absence of the Realizer in the final stages of fulfilling the task/project. Team VI has a stronger presence of strong Team workers who will provide personal leadership provide personal support to director in role of Innovator with the emphasis on creating an appropriate environment for mutual co-operation.

Team VII. The team which significant roles represent Innovator and Team worker, whose major priority is the source of key ideas and strategic, conceptual ideas, are also represented by the Specialist/Coordinator position. The risk of this team can be seen in the different attitudes and behaviours of individual team members, especially at the collegial level of Resource searchers and Specialists. This team may be expected to be inconsistent with the completion of the assignment due to the absence of members in the role of the Realizer and the Finisher.

Team VIII. It is balanced team whose members have a wide range of personal qualities. The top roles in the team are the Finisher, Coordinator, and Rectifier. Leader of team in Innovator position, who puts forward to team strategies and new ideas often benefits from the participation of members in position of Finisher, who pay attention to partial details and

guarantee high-quality processing of tasks with regard to the formulated goals with the support of the Coordinator who is involved in the creation of the organizational and management structure. If the resource searcher gets an opportunity which he/she imports into the team, he/she will get value-added results generated in partial work meetings with strategic partners including contact details and other business opportunities. The risk for a team can be conceded in the case of value difference, i.e. the orientation within the interpersonal relationships versus the orientation to the partial tasks assigned to individual team members in case of inconsistency of mutual expectations, promises, desires and wishes.

5.3 Partial Research Objective 3

By using the first method defined in the part of this paper called Data analysis method Team VIII can be considered as the only balanced team, since it meets the requirements of both formulated criteria. The requirements of the first KA1 criterion did not meet any identified team; the requirements of criterion KA2 were met by Team II (Team I close to the set limit).

For the second used method, none of the team achieved complete balance (result KB1 = 100, KB2 = 100). The most balanced team was team IV, which did not have 3 team roles, i.e. Monitor/Evaluator, Realizer and Finisher, and had only duplicated one team role that is Resource search. Team II achieved the same result in the case of the distribution of significant occupation of roles, and overall, it got a lower score in the case of doubled roles. Team VIII, which was ranked as balanced by the first method, achieved the second best result from the point of view of occupancy of natural roles, and the same as Team IV, had duplicated only one team role.

Through method 1, the author of the paper found that all styles of relationship bond are represented in Teams I, IV, V, and at the same time these teams meet the defined criteria based on defined limits. The team with representation of all styles of relationship bond and not duplicated evasive or anxious style was only team IV. In the other teams, one of the styles of relationship bond was not represented, or there was more than one.

5.4 Results of confirmation statistics

Due to the limited extent of the contribution authors provide a brief hypothesis confirmation. The obtained results from the statistical survey are summarized in chapter 5 Results and discussion.

One of the limitations of the validity of the presented results was the use of a non-random sample. Another restriction was the sample set up of members of the IT teams of the addressed company. Due to this specific sample of respondents, the research findings cannot be generalized. From the point of view of the size and structure of the sample, at the time when the survey was carried out, 53 employees were employed in the addressed company. In the company, permanent work project teams were established. Some employees were also members of several teams, and for this reason, the authors of the paper decided to include teams formed by employees of individual departments in the survey. From addressed employees 32 % employee participated in survey, the size of the resulting sample reached the minimum statistical level.

Table 1: Confirmation of hypotheses

Hypothesis	
H1a	We accept
H1b	We refuse
H1c	We accept
H1d	We refuse
H1e	We refuse
H1f	We refuse
H1g	We refuse
H1h	We refuse
H1i	We refuse
H1j	We refuse
H1k	We refuse
H1l	We refuse
H1m	We refuse
H2a	We refuse
H2b	We refuse
H3	We refuse

Research design of survey was defined as quantitative. In order to determine the style of the relationship bond, the authors of the paper used the self-assessing questionnaire ECR (Effective Consumer Response), the results of which may be inaccurate, relative, distorted, biased in relation to the file size and the frequency of the statistical survey as stated by (Vagnerová 2010). The extension of the research design on the use of qualitative research methods in the form of interviews for the purpose of assessing the styles of relationship bond as well as for completing the evaluation of inter team communication will be the subject of further investigations.

From possible boundary variants, an ECR questionnaire can be used to determine the relationship bond style in the working environment of the addressed company. The original questionnaire was focused on the field of interpersonal relationships, later on for research purposes as well as for partnership relationships due to usability and applicability in the work environment with regard to research design. In spite of this adjustment, it is necessary to draw attention to the possible limits of application of this method in working relationships, as the human population perceives relationship anxiety and avoidance differently in the working relation, but also in the social (personal) relationship as they say (Leiter, Day and Price, 2015). The organizational context (Ein-Dor 2014, p. 83-92) and a specific job description are an important factor in assessing the individual style of relationship bond in the work environment. Despite the limitations of this instrument, its use has been published in research and scientific studies, particularly in the field of work psychology, as quoted by Mikulincer and Shaver (2007).

To find a team balance from the point of view of team roles, according to van de Water et al. (2006) it is possible to use different research methods, but these methods generate different results. To increase the objectivity of evaluation of the results of the team's balance, the authors of the paper used two methods of measurement. To determine team balance, from

the point of view of relationship bond style, they chose the analogy of calculation of balancing teams in relation to team roles.

The limit of the conducted survey was the using a questionnaire for the evaluation of inter team communication according to interpretation of author Dvořáčková (2017). For team evaluation, the respondents chose the order of the teams and the distance between the individual orders. Based on the feedback from the respondents, the selection of the distance of the order of the individual teams accentuated the problematic places, which influenced the lower returns of the submitted questionnaires.

The survey was based on the correlation of the variables according to the obtained answers, not the causal relationship (Ferjenčík 2010). In processing partial data the authors used the non-parametric methods, which are suitable to take into consideration when assessing the results, with that the relationship bond style of the IT staff in the working environment of the addressed company influencing a number of other intervening variables. From the point of view of the team, it is appropriate to evaluate the structure of the composition, the individual developmental phases (Partington and Harris 1999, p. 694-705), but also the level of team cohesion (Lavy, Bareli and EinDor 2014, p. 1-23).

Depending on the layout of the relationship bond styles in the sample achieved standard layout despite the lower sample range the highest proportion of relationship bond style (69 %), uncertainty avoidance style (17 %) and anxiety style (14 %), (compared to the study of Hazan and Shaver 1987, p. 511-524); in our sample there was no disorganized style of relationship bond style. From the point of view of the distribution of styles of relationship bond by generic genesis, a higher proportion of anxiety style was significantly represented by women (21 % versus 9 % for men), whose percentages are in harmony with the presented results in the author's scientific studies (Berant 2013); men were higher in a certain style (74 % versus 63 % for women). The distribution of relationship bond styles in individual teams allows evaluating the mutual connection between variations of team composition and interring team communication evaluation. The three teams were represented by all three styles of relationship bond, two teams had only certain and anxious style, one of the teams was composed only of certain and avoiding members, one team was represented by selected individuals. The team with the highest number of evasive individuals (60 %) was composed mainly of managers (of first and second degree, n = 4; 80 %). A research study of author Lavy (2014, p. 1-23) shows that the contribution of heterogeneous teams with connection the evasive of individuals is more apparent in measuring the results of the team than in their co-operation. Evasive individuals use other strategies of regulation of emotions and interpersonal behaviour, so it may be more difficult for the team to learn get socially well with these members.

From the results of team descriptions in relation to the representation of team roles in the overall research sample, the authors consider appropriate to draw attention to the low number of team Realizer roles. Insufficient representation of this team role in six teams out of eight can support an environment of arise of undesirable problems in conceptual plans and strategic proposals, the absence of which may be reflected in the final implementation phases of the project. The highest representation was within the extraverted team role of Resource

searcher (in five teams) and Team worker (up to seven teams, in one team this role was unrepresented). In the Belbin concept (2012) teams composed of Team worker and Resource searcher are the second most common form of team composition, assuming the secondary role of the Realizer.

The methods of team balance measurement from the point of view of the team roles were used in the same way as in the conducted survey to determine the level of balance of already existing teams (van de Water, van de Water and Bukman 2006). First two the highest evaluated teams achieved the highest point values in team balance as part of team role of Resources searcher, Coordinator, and Team worker, i.e. role oriented to interpersonal relationships for which is typical openness to the outside environment, willingness to establish social relationships and contacts (Fisher, Hunter and Macrosson 1998). The teams placed in the penultimate and the last place is distinguished by the high average team score of the Innovator role (Axelson, Netz and Sandström 2017). This role is associated with creativity and information synthesis, however, the weaknesses of Innovators are not very developed communication skills (Belbin 2010), and with too much liveliness in problem solving can adversely affect open and shared communication in a team/group.

The achieved rank of the team in the assessment of inter team communication and in connection with the theory of relationship bond has been confirmed by Lavy's research (2014, p. 1-23). On the basis of the findings, the teams seem to be more competent, if their members take on different types of relationship bonds because of the different use of behavioural mechanisms, emotional control systems, and different work motivations under conditions of high team cohesion. Compared to expectations, the team with the highest share of evasive members (60 %) is the second best-rated team. According to the theoretical grounds are evasive individuals who try to keep distance from others, rather associated with the process of provoking a conflict situation. The outcome of this group can be influenced by the composition of the team in terms of the job classification of the individual team members, especially the project team leaders. One of the main work activities of these employees is the transfer of information from customers to the company and the supervision of the fulfilment of customer requirements within the other departments. Surprisingly, the placement in the evaluation of mutual communication is in a team composed only of individuals with a certain relationship bond. Even in one of the five evaluated questions, addressed workers of IT department did not rank first (for the three evaluated questions they achieved point score to the last place, that is for the question focuses on sharing the necessary information, open communication and willingness to understand others). This result is not congruent with theoretical assumptions, as these individuals are characterized by developed social skills, empathy, adaptability (Geller and Bamberger 2009, p. 1803-1827; Guerro and Jones 2005; Mikulincer and Shaver 2007).

In the case of a sample of respondents, the authors of the contribution found a positive significant link between the team role of Specialist and the evasive dimension, and the negative significant link between the team role of Resource search and dimension of avoidance. Despite the fact that no dependence was confirmed in other team roles, the authors of the paper believe that this way of thinking and assessing is appropriate.

In the case of another follow-up test hypothesis, there was no found consensus in sufficient evidence of a link between respondents' assessment and observers of questionnaire of team roles and avoidance/anxiety dimension. The assumption that certain individuals will show a higher consensus in the overall rating and self-image was not met.

In the case of testing of connection of team balance from the point of view of team roles and the heterogeneity of the team composition from the point of view of the relationship bond style, there was not found sufficient evidence of mutual relationships within the examined relationships.

In the case of testing connection between achieved orders in evaluation inter team communication and the team's balance from the point of view of team roles, there was established significant connection from five cases. The obtained results pointed to the fact that the use of criteria on the example of a team role in relation to team balance assessment can be an appropriate tool for inter team communication and social integration.

6 Conclusion

John Bowlby's theory of relationship bond is based on the assumption that an individual in society has a congenital psychological system that motivates him/ her to search for the proximity of prominent persons (usually mothers) especially in cases of threats. If a close person responds sensitively to the individual's requirements and needs, he or she creates space for a secure relationship bond style with accent on a constructive strategy to cope with potential threats or the regulation of negative emotions. Insufficient or inconsistent interactions of a close person are more likely to develop insecure relationship bond. Experience with a close person is the foundation of internal working models that include ways of thinking, conscious and unconscious feelings and expectations of the future. Essential importance for the development of relationship bond theory had the author Aisworth, who, based on child observation, divided the behaviour of emotional ties into three formulas to a certain, uncertain, evasive and uncertain anxiety style. With regard to the time horizon, the fourth bond style was then created as an uncertain disorganized. Another author, Bowlby, hypothesizes that relationship bond theory is the relevant framework for explaining relationships and behaviours throughout human life. Relationship bond theories can be applied to relationships that meet the criteria of keeping proximity, safe harbour, and social being.

Relationship bond theory can be extended to the prediction of the relationship perception and behaviour of the individual in the work environment. Knowledge and understanding of the different manifestations of each relationship bond style within groups or organizations can contribute to increasing team functionality. Relationships bond researches in the workplace focus on interpersonal working relationships (relationship with the leader, team, organization, colleagues) and behaviour in the organization (performance, well-being, relationship to work). One of the unclear research questions is the optimal composition of teams/groups or the possible ratio of representation of individual styles of relationship bond styles.

In current organizations, teams become a core work unit. Successful teamwork relies on synergy between all team members who are willing to participate in creating a positive team environment. Achieving greater team efficiency can be achieved by coordinating team roles. One of the most widespread methods of team role identification is a formulated Belbin concept that has identified nine roles on the basis of study of management teams, that a balanced team is that one in which all the team roles are strongly represented.

The basis for the meaningfulness of individuals and groups in an organization is inter-team communication. Internal communication is not just a transfer of information; it encourages the creation of favourable interpersonal relationships, corporate culture and shared values. In today's organizations, it is becoming one of the most demanding areas of inter group communication.

The research goal of the contribution authors was to find out the connection between the team roles and the style of the relationship bond on the sample of selected teams in the addressed company, as well as the links between the balance of the team composition from the point of view of the team roles and the relationship bond style, and the relations between evaluation of the inter team communication and the composition of the individual team members.

For the valuable findings, the authors of the contribution consider the above-mentioned knowledge of the distribution of relationship bond style in phase of adulthood of individual to a sample of human population in the addressed company in the IT workers, including the interpretation of the obtained results according to the differentiation of the relationship bond styles of the working teams. As stated (Lavy, 2014, p. 1-23), there are only a few surveys dealing with the positive effects of the heterogeneous composition of working teams in relation to attachment style. Existing surveys of the potential benefit of heterogeneous teams from the point of view of relationship bond were directed mainly at threats situations (Ein-Dor, and Perry 2014, p. 83-92; Ein-Dor, Mikulincer, Doron and Shaver 2010, p. 123-141) and did not devote to the standard work situations, which offers additional alternatives for scientific research. On the date of processing conducted research, the authors of the paper did not know the scientific work/study that would deal with the appropriate/balanced composition of the teams with respect to the styles of the relationship bonds. The survey appeals to the potential positive outcome of the involvement of both uncertain styles of relationships bond in the teamwork. Discovered results of Lavy et al. (2014, p. 1-23) point to the benefits of connection of evasive individuals to working teams and also highlight the possible problems associated with the need to cope with others who use different control strategies. With respect to this fact it is appropriate to extend quantitative research to qualitative exploration of the functionality of heterogeneous teams.

The application benefit of the realized study is based on the applicability of the obtained results of the relationship bonds through mutual communication and social interaction between the selected teams workers of IT department in which the survey was realized, especially in the area of recruiting new employees with the aim of enriching the existing teams with other suitable individuals in the role of the Realizer to increase the efficiency of introducing new partial projects with the emphasis on extending the involvement of „eligible“

team members as a stabilizing and development element of a successful, healthy, efficient and functional team.

References

- Axelsson, M., Netz, J., & Sandström, C. (2017). Collective action problems in public sector innovation: A business model perspective. *Creativity and Innovation Management*. Vol. 26. No. 4.
- Bednář, V. (2013). *Sociální vztahy v organizaci a jejich management*. Praha: Grada Publishing.
- Belbin, M. R. (2010). *Týmové role v práci*. Praha: Wolters Kluwer ČR.
- Belbin, M. R. (2012). *Manažerské týmy: proč některé uspějí a jiné selžou*. Praha: Wolters Kluwer ČR, a.s.
- Bělohávek, F. (2008). *Jak vést svůj tým*. Praha: Grada Publishing.
- Boccatto, G., & Capozza, D. (2011). *Attachment Styles and Social Groups: Review of a Decade*. TPM. Vol. 18. No.1.
- Bowlby, J. (2010). *Vazba: teorie kvality raných vztahů mezi matkou a dítětem*. Praha: Portál.
- Brennan, K., Clark, C., & Shaver, P. (1998). *Self-report measurement of adult romantic attachment: An integrative overview*. New York: Guilford Press.
- Caha, Z. (2017). Central Europe: Ethical Overlaps of Environmental and Economic Interests in Coming Years. *Science and Engineering Ethics*. 10.
- Dierendonck, D. V., & Groen, R. (2011). Belbin revisited: A multitrait–multimethod investigation of a team role instrument. *European Journal of Work and Organizational Psychology*. Vol. 20. No. 3.
- Ein-Dor, T. (10. 12. 2014). *Frontiers in Psychology*. 10. 1. 2018. Available from: <http://journal.frontiersin.org/article/10.3389/fpsyg.2014.01452/full#B46>: <http://journal.frontiersin.org>.
- Ein-Dor, T., & Perry, A. (8. 2. 2014). *Full house of fears: evidence that people high in attachment anxiety are more accurate in detecting deceit*. J. Pers. 5.
- Ein-Dor, T., Mikulincer, M., Doron, G., & Shaver, P. R. (2. 5. 2010). The attachment paradox: how can so many of us (the insecure ones) have no adaptive advantages? *Perspect. Psychol. Sci.* 5.
- Ferjenčík, J. (2010). *Úvod do metodologie psychologického výzkumu*. Praha: Portál.
- Gavora, P. (2008). *Úvod do pedagogického výzkumu*. Bratislava: Univerzita Komenského.
- Geller, D., & Bamberger, P. (2009). Bringing avoidance and anxiety to the job: Attachment style and instrumental helping behavior among co-workers. *Human Relations*. Vol. 62. No. 12.
- Hazan, C., & Shaver, P. (52 1987). Romantic love conceptualized as an attachment process. *Journal of Personality and Social Psychology*. Vol. 52. No. 3.
- Holátová D., & Březinová M. (2013). *Basic characteristics of small and medium-sized enterprises in terms of their goals*. *International Journal of Business and Social Science*. Vol. 4. No. 15.
- Isaacson, W. (2011). *Steve Jobs*. Praha: Práh.
- Janoušek, J. (2015). *Psychologické základy verbální komunikace*. Praha: Grada Publishing, a.s.
- Lavy, S., Bareli, Y., & Ein-Dor, T. (2014). *The effects of attachment heterogeneity and team cohesion on team functioning*. Small Group Research.

- Lečbych, M., & Pospíšiliková, K. (2012). *Česká verze škály ECR: Pilotní studie posouzení vztahové vazby v dospělosti*. 30. 12. 2017. Available from: e-psycholog.eu: <http://epsycholog.eu/pdf/lecbych-pospisilikova.pdf>.
- Leiter, M. P., Day, A., & Price, L. (2015). *Attachment styles at work: Measurement, collegial relationships, and burnout*. 1.1.2018. Available from: <http://dx.doi.org/10.016/j.burn.2015.02.003>.
- Mikulincer, M., & Shaver, P. R. (2007). *Attachment in Adulthood: structure, dynamics, and change*. New Your City: The Guilford Press.
- Partington, D., & Harris, H. (1999). Team role balance and team performance: an empirical study. *Journal of Management Development*. Vol. 18. No. 8.
- Pisani, M. (2012). The Impact of Team Composition and Inetrpersonal Communicationon Peceived Team Performance- A Case Study. *European Journal of Social Sciences*. Vol. 35. No. 3.
- Plamínek, J. (2012). *Komunikace a prezentace*. Praha: Grada Publishing.
- Plamínek, J. (2011). *Vedení lidí, týmů a firem: Praktický atlas managementu*. Praha: Grada Publishing.
- Rom, E., & Mikulincer, M. (2003). Attachment Theory nd Group Processes: The Association Between attachment Style and Group-Related Representations, Goals, Memories, and Functioning. *Journal of Personality and Social Psychology*. Vol. 84. No. 6.
- Seitl, M., Charvát, M., & Lečbych, M. (nepublikováno). Psychometrické charakteristiky české verze škály Experiences in Close Relationships (ECR). *Československá psychologie*.
- Senior, B. (1997). Tam roles and team performance: Is there "really" a link? *Journal of Occupational and Organizational Psychology*.Vol. 70. No. 3.
- Smith, M., Polglase, G., & Parry, C. (2012). Construction of Student groups Using Belbin: Supporting Group Work in Environmental Management. *Journal of Geography i Higher Education*. Vol. 36. No. 4.
- Thomas, G. F. (2009). The Central Role of Communication in Developing Trust and its Effect on Employee Involvement. *Journal of Business Communication*. Vol. 46 No. 3.
- Urbánek, T. D. (2011). *Psychometrika: Měření v psychologii*. Praha: Portál.
- Vágnerová, M. (2010). *Psychologie osobnosti*. Praha: Karolinum.
- van de Water, T., van de Water, H., & Bukman, C. (2006). A balanced team generating model. *European Journal of Operational Research*. Vol. 180. No. 2.
- Vnoučková, L., Urbancová, H., & Smolová, H. (2015). Responsibility of Czech employees and organisations in relation to development. *Proceedings of the 12th International Conference on Efficiency and Responsibility in Education*, Prague, Czech University of Life Sciences.
- Williams, M. (2001). In Whom We Trust: Group Membership as an Affective Context for Trust Development. *Academy of Management Review*.Vol. 26. No. 3

National Cases

Danielle Dimitrov

This stream aims to reminisce the realities and plan the future states of our knowledge-based global economy at the beginning of the 21st century, through the prism of the colorful national cultures. Papers share the countries' present truth and future goals in terms of the relationship between theorizing and applying research in the everyday knowledge economy. They get specific and concentrate on problem-solving and case-analyzing various examples of competitiveness, innovation, and entrepreneurship in their national economy.

Comparison of import and export dependence of Croatia and Poland in period from 1994 to 2016

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Abstract: In this paper export and import dependence for Croatia and Poland are calculated and compared for the years from 1994 to 2016. Trade dependence refers to dependency on imports from and exports to abroad. It is preferable for country to have lower values of trade dependence, otherwise it can experience economic vulnerability on external shocks. Concentration levels are measured by using concentration ratio and Herfindahl-Hirschman's concentration index. Results of the analysis has shown that Croatia and Poland are highly dependent on its most important export and import trading partners with concentration ratio higher than 0.5 in the observed period. If total concentration levels are observed including all trading partners, export and import concentration leves in Croatia and Poland can be treated as low. Methodology and framework constructed in this paper can be applied in estimating trade dependence for other individual countries or group of countries.

Keywords: export and import dependence; concentration measures; Croatia and Poland

1 Introduction

This paper investigates and gives comparison of import and export dependence for Croatia and Poland in the period from 1994 to 2016. The higher export or import concentration level is, the higher trade dependence level Croatia and Poland with some countries have. It is preferable for a country to have lower export and import concentration level, because in that case trade risk is dispersed among larger number of countries. Country's trade dependence refers to dependency on imports from and exports to abroad. It is closely related to country's trade openness (United Nations 2011). Trade openness is measured by sum of country's imports and exports divided by its gross domestic product. As country is more opened it is more vulnerable on external shocks. Economic vulnerability can be transmitted from import or/and export-side. Countries can be vulnerable to economic shocks but this impact depends largely on the trade concentration level. Export concentration is closely related to number of trade partners individual country has. According to Salomon (2010) export concentration can take several dimensions and can be analysed at different levels taking two forms (horizontal and vertical diversification). Country that exports to only one or limited number of trading partners has higher degree of export concentration. On the other side, country that exports to many countries has lower degree of export concentration and consequently more diversified export structure. In that way it can be protected from exogenous economic shocks

such as change in terms-of-trade, emergence of a political situation and conflicts, exchange rate shocks, etc. Small, land-locked economies are often very vulnerable to external shocks from abroad. A popular way to measure import and export dependence is by calculating trade concentration indices. According to Songwe and Winkler (2012) diversity in exports can reduce income volatility for countries with large populations and reduce vulnerability to sharp declines in terms-of-trade.

Croatia and Poland are both member countries of European Union. They have relatively diversified import and export trade structures. It is expected in the analysis to get lower values of import and export concentration for both countries. It will be interesting to investigate most important trading partners for Croatia and Poland using z-score and concentrations ratios 1, 2 and 4 for trade with individual countries and groups of countries. Accordingly, the research hypothesis of the paper is the following one:

H1: Import and export dependence of Croatia and Poland measured by concentration ratios can be treated as low.

It is important to precisely calculate and assess a degree of export and import dependence in order to give clear guidelines to economic policy makers, for example encouraging diversification of country's export portfolios. After the introduction, in the second chapter data sources and methods are presented. In the third chapter descriptive statistics of exports and imports of Croatia and Poland is analysed whereas in the fourth chapter the most important trading partners of Croatia and Poland are displayed. Fifth chapter exhibits concentration level analysis of export and import in Croatia and Poland. The sixth chapter concludes the paper and brings some recommendations for further research.

2 Data and methods

In the paper exports and imports of Croatia and of Poland in the period from 1994 to 2016 are observed. The data about exports and imports are taken from World Integrated Trade Solution (WITS) database which is a joint project of following institutions: the World Bank, the United Nations Conference on Trade and Development, International Trade Center, United Nations Statistical Division and the World Trade Organization (WITS, 2018a). In the analysis exports to and imports from other countries and group of countries will be observed. The list of variables used in the analysis is presented in Table 1.

Table 1: List of observed variables

Variable description	Variable source
Export from Croatia, country level, in thousand US\$, from 1994 to 2016	WITS, 2018b
Export from Croatia, group of countries, in thousand US\$, from 1994 to 2016	WITS, 2018c
Import to Croatia, country level, in thousand US\$, from 1994 to 2016	WITS, 2018f
Import to Croatia, group of countries, in thousand US\$, from 1994 to 2016	WITS, 2018g
Export from Poland, country level, in thousand US\$, from 1994 to 2016	WITS, 2018d
Export from Poland, group of countries, in thousand US\$, from 1994 to 2016	WITS, 2018e
Import to Poland, country level, in thousand US\$, from 1994 to 2016	WITS, 2018h
Import to Poland, group of countries, in thousand US\$, from 1994 to 2016	WITS, 2018i

In the first step, time series of total exports and total imports of both countries will be observed and compared. In the following step, the most important trade partners of both countries will be identified. In order to inspect the effects of the most important trade partners on the economy of the observed country, concentration analysis will be applied.

At the beginning of the analysis, basic descriptive statistics methods will be used. In order to detect the most important trade partners standardized variable will be applied. Standardized variable or z-score is calculated using following equation:

$$z_i = (x_i - \mu) / \sigma, \quad i = 1, 2, \dots, N, \quad (1)$$

where z_i is the z-score of a certain country or group of countries, x_i is the value of import or export of the observed country or group of countries, μ is average import or average export of Croatia or Poland in a observed year, σ is standard deviation of import or average export of Croatia or Poland in the observed year, N is total number of countries or group of countries with which Croatia or Poland had achieved some trade in a observed year. Those z-scores are calculated separately for Croatia and for Poland by taking into account export or import only and for each observed year. It is assumed that a country is important trade partner if its z-score is higher than two. This analysis will be applied by taking into account group of countries as well.

In order to inspect how much influence identified trade partners on economies of Croatia and Poland have, the concentration ratio will be applied. The concentration ratio is defined as:

$$CR_r = \frac{\sum_{i=1}^r x_i}{\sum_{i=1}^N x_i}, \quad r = 1, 2, \dots, N, \quad (2)$$

where CR_r is concentration ratio for first r countries or group of countries with the highest value of the import or export, $\sum_{i=1}^r x_i$ is sum of import or export for first r countries or group of countries, $\sum_{i=1}^N x_i$ is sum of import or export for all N countries or group of countries (Dumičić, Žmuk, Knežević, 2017). In addition, in order to estimate general trade exposure of the country Herfindahl-Hirschman's concentration index will be used. The Herfindahl-Hirschman's concentration index is calculated as follows:

$$HHI = \sum_{i=1}^N p_i^2, \quad (3)$$

where HHI is the Herfindahl-Hirschman's concentration index, p_i is proportion of the i -th country or group of countries in the total value of the import or export (Herfindhal 1950; Hirschman 1980; Bikker and Haaf 2002). Due to small number of units, when group of countries are observed standardized concentration ratio and standardized Herfindahl-Hirschman's concentration index will be applied to get more accurate value (Dumičić, Žmuk and Knežević 2017).

3 Descriptive statistics analysis of exports and imports of Croatia and Poland

In this chapter descriptive statistics analysis of exports and imports of two countries, Croatia and Poland, in period from 1994 to 2016 will be observed. In order to better understand how export and import changed in the observed period, the values of total exports and total imports for Croatia and Poland are shown in Figure 1.

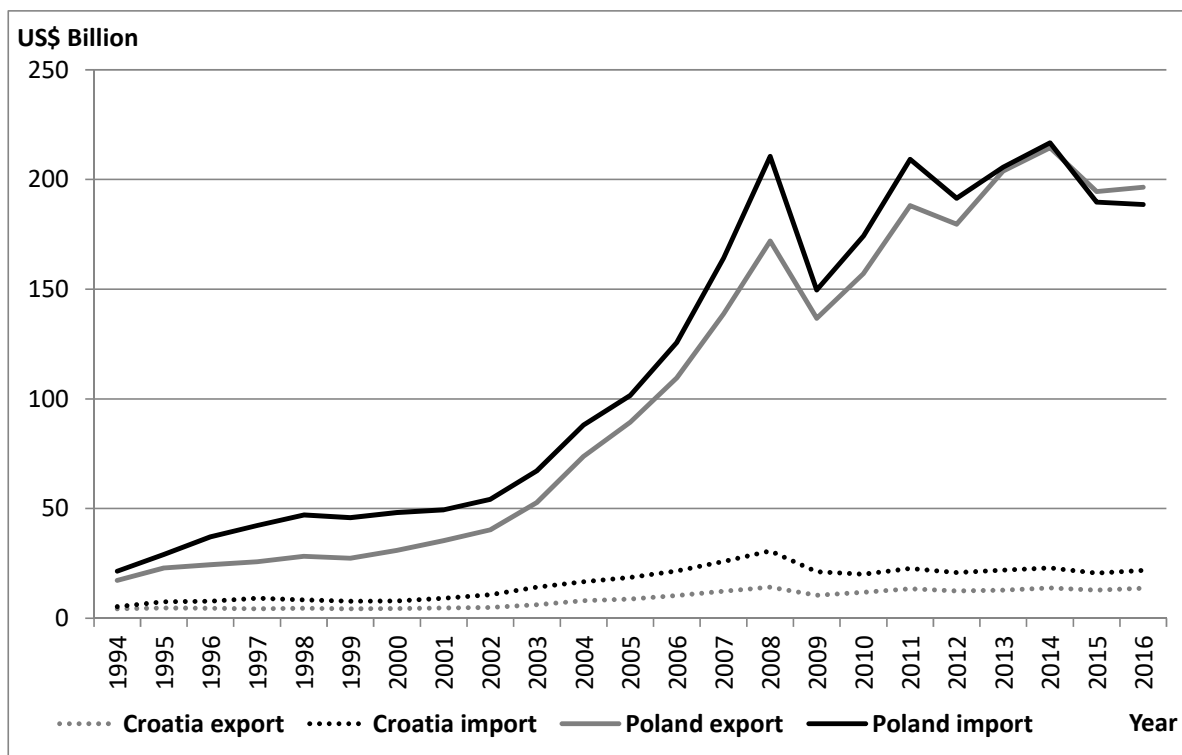


Figure 1: Total exports and total imports comparison between Croatia and Poland in period from 1994 to 2016

According to Figure 1 it can be noticed that in the whole observed period Poland had higher values of export and import than Croatia. Those differences became even more noticeable since the year 2004 when Poland entered the European Union. It is interesting that such effect of accessing the European Union on exports and imports was not present in the case of Croatia, which entered the European Union in 2013. Sharp increase in exports and imports in Poland was stopped in 2008 by the global financial crisis. However, Poland recovered quite quickly, and already in 2011 values of exports and imports from 2008 were reached. On the other hand, Croatia had also decrease in exports and imports due to the global financial crisis but its exports did not reach pre-crisis values. Despite that, in the whole observed period imports were higher than exports. As opposed to that, Poland achieved higher values of exports than imports in 2015 and 2016.

Table 2: Basic descriptive statistics results for variable export in Croatia and in Poland, country level, in selected years, in thousands of US \$

Statistics	Year						
	1994	1998	2002	2006	2010	2014	2016
Croatia							
N	157	141	151	166	162	182	179
Mean	27,136	32,206	32,474	62,512	72,905	76,065	76,243
Median	477	771	1,158	1,473	4,644	1,882	2,291
St. dev.	117,145	117,809	126,449	243,718	242,491	262,593	258,006
Coeff. var.	432	366	389	390	333	345	338
Min	0.574	1.261	0.115	0.382	0.109	0.206	0.022
Max	941,462	802,273	1,114,986	2,397,480	2,209,839	1,921,192	1,864,302
Range	941,462	802,272	1,114,986	2,397,479	2,209,838	1,921,192	1,864,302
Poland							
N	161	163	175	209	210	218	224
Mean	106,797	172,967	230,022	524,326	747,928	983,839	877,032
Median	6,780	7,944	6,674	8,207	18,902	30,841	22,150
St. dev.	504,799	842,782	1,068,158	2,323,754	3,236,408	4,256,683	3,973,029
Coeff. var.	473	487	464	443	433	433	453
Min	50.000	58.000	50.000	0.018	0.166	0.028	0.068
Max	6,114,637	10,233,276	13,209,198	29,701,290	40,890,945	55,615,019	53,033,745
Range	6,114,587	10,233,218	13,209,148	29,701,290	40,890,945	55,615,019	53,033,745

In Table 2 basic descriptive statistics results regarding exports of Croatia and Poland are presented. Due to limited space, the results are shown only for certain years. If the number of countries in which Croatia and Poland export is compared, it can be concluded that Poland had convincingly more exporting countries than Croatia. The difference is especially emphasized in the recent years. According to the results, average export value per exporting country in Poland is about 10 times higher than the average export value in Croatia. When different countries are observed, there are present great differences in export values. That is true in the case of Croatia and Poland in the whole observed period. It is shown by huge range of values and by high values of coefficient of variation. Consequently, it is recommended to observe median instead of the average value. Still, even when median values are compared, it can be concluded that Poland has better export statistics than Croatia.

Table 3: Basic descriptive statistics results for variable import in Croatia and in Poland, country level, in selected years, in thousands of US \$

Statistics	Year						
	1994	1998	2002	2006	2010	2014	2016
Croatia							
N	154	151	196	204	210	167	169
Mean	33,955	55,517	54,704	105,404	95,557	137,167	129,171
Median	499	2,018	535	491	546	1,788	1,465
St. dev.	133,117	198,935	209,707	401,902	341,116	468,683	437,709
Coeff. var.	392	358	383	381	357	342	339
Min	0.702	0.617	0.069	0.151	0.104	0.006	0.010
Max	1,109,715	1,615,900	1,850,945	3,600,331	3,055,675	3,463,093	3,517,264
Range	1,109,715	1,615,899	1,850,945	3,600,331	3,055,675	3,463,093	3,517,264

Poland							
N	140	159	170	226	227	229	228
Mean	153,096	295,622	319,214	555,953	767,082	946,233	826,833
Median	7,591	7,735	8,604	5,947	8,124	11,589	10,168
St. dev.	551,751	1,128,846	1,209,640	2,395,488	3,196,300	3,995,152	3,529,765
Coeff. var.	360	382	379	431	417	422	427
Min	55.000	65.000	53.000	0.022	0.056	0.004	0.033
Max	5,843,929	12,441,095	13,362,474	30,144,454	37,784,400	47,026,899	43,177,701
Range	5,843,874	12,441,030	13,362,421	30,144,454	37,784,400	47,026,899	43,177,701

Similarly to Table 2, in Table 3 are shown basic descriptive statistics of imports for Croatia and Poland in certain years. Again it can be noticed that Poland had in recent years far more trading partners than Croatia. As it was shown for export, there are also huge differences in import values when individual countries are observed. In other words, it has been shown that there are some countries with which Croatia and Poland prefer to trade much more than with others. Those countries will be identified in the following chapter.

4 The most important trade partners of Croatia and Poland

Descriptive statistics analysis has shown that both observed countries, Croatia and Poland, conduct more valuable trade, exports and imports, with some countries than the others. Croatia and Poland are therefore dependable upon those countries. If some problems regarding trade with those countries would appear, that could have huge impact on general economy of Croatia and Poland.

In order to detect very important trade partners, z-score approach will be applied. In statistical sense, the aim here is to detect outliers. In other words, the aim is to find countries which export or import values are significantly higher than at other countries which conducted some trade with Croatia and Poland. It has been decided that countries with z-score higher than two will be considered as important trade partners. In Table 4 such countries regarding exports to and imports from for Croatia and Poland in the period from 1994 to 2016 are listed.

Table 4: The most important trade partners of Croatia and Poland, z-score approach, export and import are observed separately, in period from 1994 to 2016

Year	The most important trade partners			
	for Croatia		for Poland	
	Export	Import	Export	Import
1994	DEU (7.81), ITA (7.54), SVN (4.51), BIH (2.66)	DEU (8.08), ITA (7.22), SVN (3.81), AUT (2.39)	DEU (11.90)	DEU (10.31), ITA (2.95), RUS (2.33)
1995	ITA (8.03), DEU (7.27), SVN (4.34), BIH (2.65)	DEU (7.88), ITA (7.11), SVN (4.08), AUT (2.84), GBR (2.19)	DEU (12.12)	DEU (10.29), ITA (3.11), RUS (2.40)
1996	ITA (7.50), DEU (6.60), SVN (4.74), BIH (4.23)	DEU (8.01), ITA (7.08), SVN (3.71), AUT (2.82)	DEU (11.66), RUS (2.12)	DEU (9.87), ITA (3.80), RUS (2.51), GBR (2.14)
1997	ITA (7.15), DEU (6.08), BIH (5.05), SVN (4.08)	DEU (8.05), ITA (7.53), SVN (3.15), AUT (2.94)	DEU (11.80), RUS (2.83)	DEU (10.15), ITA (4.01), RUS (2.47), FRA (2.28), GBR (2.10)
1998	ITA (6.54), DEU (6.24), BIH (5.28), SVN (3.40), LBR (2.58)	DEU (7.84), ITA (7.26), SVN (3.35), AUT (2.80)	DEU (11.94)	DEU (10.76), ITA (3.64), FRA (2.43)
1999	ITA (6.97), DEU (6.04), BIH (4.86), SVN (3.98), AUT (2.20)	DEU (7.64), ITA (6.51), RUS (3.39), SVN (3.10), AUT (2.73)	DEU (11.60)	DEU (10.29), ITA (3.65), FRA (2.58), RUS (2.16)
2000	ITA (8.39), DEU (5.26), BIH (4.06), SVN (3.93), AUT (2.29)	ITA (7.75), DEU (7.67), RUS (3.84), SVN (3.56), AUT (2.96), FRA (2.40)	DEU (12.10), ITA (2.01)	DEU (10.26), RUS (3.89), ITA (3.37), FRA (2.54)
2001	ITA (9.05), DEU (5.54), BIH (4.46), SVN (3.33), AUT (2.00)	ITA (8.56), DEU (8.17), SVN (3.53), RUS (3.22), AUT (3.10)	DEU (12.25)	DEU (10.45), RUS (3.67), ITA (3.40), FRA (2.75)

2002	ITA (8.56), BIH (5.31), DEU (4.58), SVN (3.13), AUT (2.64)	ITA (8.57), DEU (8.05), SVN (3.68), RUS (3.16), AUT (3.12), FRA (2.39)	DEU (12.15), FRA (2.08)	DEU (10.78), ITA (3.52), RUS (3.37), FRA (2.88)
2003	ITA (9.58), BIH (5.07), DEU (4.12), SVN (2.80), AUT (2.62)	ITA (9.22), DEU (7.90), SVN (3.60), AUT (3.20), FRA (2.49), RUS (2.23)	DEU (12.30), FRA (2.15), ITA (2.00)	DEU (10.86), ITA (3.60), RUS (3.24), FRA (2.94)
2004	ITA (8.88), BIH (5.49), DEU (4.20), AUT (3.51), SVN (2.74)	ITA (8.88), DEU (8.07), RUS (3.65), SVN (3.56), AUT (3.41), FRA (2.11)	DEU (13.17), ITA (2.52), FRA (2.48), GBR (2.20)	DEU (12.56), ITA (3.90), RUS (3.58), FRA (3.30), CHN (2.19)
2005	ITA (8.54), BIH (5.68), DEU (4.16), SVN (3.10), AUT (2.71)	ITA (8.50), DEU (7.85), RUS (4.75), SVN (3.45), AUT (2.88), CHN (2.31), FRA (2.03)	DEU (12.71), FRA (2.63), ITA (2.59), GBR (2.34)	DEU (12.50), RUS (4.34), ITA (3.42), FRA (2.87), CHN (2.56)
2006	ITA (9.58), BIH (5.12), DEU (4.14), SVN (3.24), AUT (2.32), SRB (2.00)	ITA (8.70), DEU (7.52), RUS (5.13), SVN (3.10), AUT (2.65), CHN (2.59)	DEU (12.56), ITA (2.85), FRA (2.71), GBR (2.47), CZE (2.39)	DEU (12.35), RUS (4.84), ITA (3.33), CHN (2.99), FRA (2.64)
2007	ITA (8.48), BIH (6.34), DEU (4.31), SVN (3.51), AUT (2.53), SRB (2.19)	ITA (8.52), DEU (7.62), RUS (5.28), CHN (3.13), SVN (2.99), AUT (2.63)	DEU (12.30), ITA (2.96), FRA (2.71), GBR (2.64), CZE (2.45), RUS (2.01)	DEU (12.46), RUS (4.39), CHN (3.55), ITA (3.39), FRA (2.47)
2008	ITA (8.29), BIH (6.65), DEU (4.55), SVN (3.22), AUT (2.32), SRB (2.20)	ITA (9.37), DEU (7.28), RUS (5.60), CHN (3.20), SVN (2.88), AUT (2.51)	DEU (12.28), FRA (2.86), ITA (2.74), GBR (2.64), CZE (2.61), RUS (2.35)	DEU (11.96), RUS (4.93), CHN (3.99), ITA (3.21), FRA (2.26)
2009	ITA (8.81), BIH (5.87), DEU (4.96), SVN (3.26), AUT (2.30), SRB (2.28)	ITA (8.47), DEU (7.37), RUS (5.09), CHN (3.57), SVN (2.96), AUT (2.56)	DEU (12.30), FRA (3.10), ITA (3.04), GBR (2.85), CZE (2.58)	DEU (11.82), CHN (4.78), RUS (4.39), ITA (3.43), FRA (2.25)
2010	ITA (8.81), BIH (5.34), DEU (4.72), SVN (3.51), AUT (2.27)	ITA (8.68), DEU (7.07), RUS (5.06), CHN (3.94), SVN (3.16), AUT (2.52)	DEU (12.40), FRA (3.08), GBR (2.85), ITA (2.67), CZE (2.65)	DEU (11.58), RUS (5.45), CHN (4.93), ITA (2.80), FRA (2.11)
2011	ITA (8.12), BIH (6.23), DEU (5.08), SVN (4.11), AUT (2.74)	ITA (9.31), DEU (7.06), RUS (3.94), CHN (3.85), SVN (3.35), AUT (2.33)	DEU (12.55), GBR (2.95), CZE (2.82), FRA (2.79), ITA (2.41), RUS (2.00)	DEU (11.65), RUS (6.30), CHN (4.40), ITA (2.62)
2012	ITA (8.09), BIH (6.70), DEU (5.30), SVN (4.43), AUT (3.29), SRB (2.09)	ITA (9.59), DEU (7.16), RUS (4.18), CHN (3.91), SVN (3.15), AUT (2.37)	DEU (12.39), GBR (3.19), CZE (2.91), FRA (2.71), RUS (2.55), ITA (2.24), NLD (2.01)	DEU (10.84), RUS (7.50), CHN (4.54), ITA (2.43)
2013	ITA (7.36), BIH (6.16), DEU (5.89), SVN (5.19), AUT (3.01), SRB (2.19)	DEU (6.85), ITA (6.39), SVN (5.54), AUT (4.28), HUN (2.89)	DEU (12.75), GBR (3.16), CZE (2.96), FRA (2.69), RUS (2.52), ITA (2.01)	DEU (11.34), RUS (6.37), CHN (4.81), ITA (2.57)
2014	ITA (7.03), BIH (5.96), SVN (5.69), DEU (5.61), AUT (2.92), SRB (2.66)	DEU (7.10), ITA (6.67), SVN (4.99), AUT (3.93), HUN (2.91), RUS (2.18)	DEU (12.83), GBR (2.98), CZE (2.92), FRA (2.59), ITA (2.05)	DEU (11.53), RUS (5.62), CHN (5.52), ITA (2.61)
2015	ITA (6.93), SVN (6.33), DEU (5.82), BIH (4.96), AUT (3.24), SRB (2.66)	DEU (7.15), ITA (6.01), SVN (4.81), AUT (4.08), HUN (3.42)	DEU (13.08), GBR (3.15), CZE (3.01), FRA (2.53), ITA (2.15)	DEU (11.96), CHN (6.13), RUS (3.85), ITA (2.56)
2016	ITA (6.93), SVN (6.31), DEU (5.94), BIH (4.55), AUT (3.09), SRB (2.23)	DEU (7.74), ITA (6.00), SVN (5.15), AUT (3.68), HUN (3.25)	DEU (13.13), GBR (3.05), CZE (2.99), FRA (2.49), ITA (2.15)	DEU (12.00), CHN (6.41), RUS (3.03), ITA (2.49)

Notes: z-scores are shown in brackets. ISO 3166-1 alpha-3 codes were used for names of countries. Serbia and Montenegro are observed together.

According to Table 4, it has been shown that the most important Croatian export partners are Italy, Slovenia, Germany, Bosnia and Herzegovina, Austria and Serbia. On the other hand, the most important Croatian import partners appear to be Germany, Italy, Slovenia, Austria and Hungary. In some years, China and Russia came out to be very important Croatian import partners, also. If lists of important export and import Croatian partners are compared, it can be concluded that some countries can be found on both lists. Croatia is especially exposed to trade with Germany, Italy, Slovenia and Austria.

If Poland export partners are observed, the most important ones turned out to be Germany, United Kingdom, Czech Republic, France and Italy. In some years Russia can be observed as important Poland export partner, too. On the other hand, the most important Poland import partners are Germany, China, Russia, Italy and France. The main characteristic of Poland trade is its high exposure to Germany. Namely, in the whole observed period the highest export and import values Poland convincingly had with Germany.

In Table 4 the most important trade partners are emphasized. However, that analysis was conducted by observing individual countries only. It would be interesting to inspect with which

region of the World Croatia and Poland prefer to conduct a trade, too. In order to do that, countries are grouped according to their geographical location in the following seven groups of countries: East Asia & Pacific; Europe & Central Asia; Latin America & Caribbean; Middle East & North Africa; North America; South Asia; Sub-Saharan Africa. The most important group of countries, from trade perspective for Croatia and Poland, will be determined by using z-score approach as well.

In all observed years z-score approach has shown that the most important country group for Croatia and Poland is Europe & Central Asia. Z-score ranged from 2.38 to 2.45 for both countries. So, trade of Croatia and Poland is very dependent on the events on those markets. In the following chapter the level of dependence will be estimated by using selected concentration measures.

5 Concentration level analysis of exports and import in Croatia and Poland

The higher export or import concentration level is, the higher trade dependence level Croatia and Poland with some countries have. In case of economic crisis that could be a serious problem. Therefore, it is preferable that a country has export and import concentration level as lower as possible, because on that way risk of trade is dispersed among large number of countries. The concentration level will be first measured by using concentration ratio and then by using Herfindahl-Hirschman's concentration index. The number of countries included in the calculation of concentration ratio will be determined by the number of the most important trade partners of Croatia and Poland (see Table 4). However, in order to compare concentration level in Croatia and Poland, concentration ratios 1, 2 and 4 will be calculated as well. After the calculation of concentration ratios by taking into account individual countries, concentration ratios 1, 2 and 4 will be additionally calculated by taking into account group of countries. In Figure 2 concentration ratios by taking into account export only and individual countries are shown.

According to Figure 2, where concentration ratio N is observed, it can be concluded that Croatia is highly dependent on its most important export partners. Namely, in the whole observed period concentration ratio is higher than 0.5. On the other hand, Poland had lower concentration ratio N values than Croatia. However, in the recent years the concentration ratio N values were about 0.5, which lead to the conclusion that Poland is also highly dependent on its the most important export partners. If concentration ratio 1 is observed it can be concluded that Poland is more dependent on it's the most important export partner (Germany) than Croatia in the period from 1994 to 2016. If two and four the most important export partners of Croatia and Poland are taken into the account, it can be concluded that both countries have about the same concentration level or about the same dependence level.

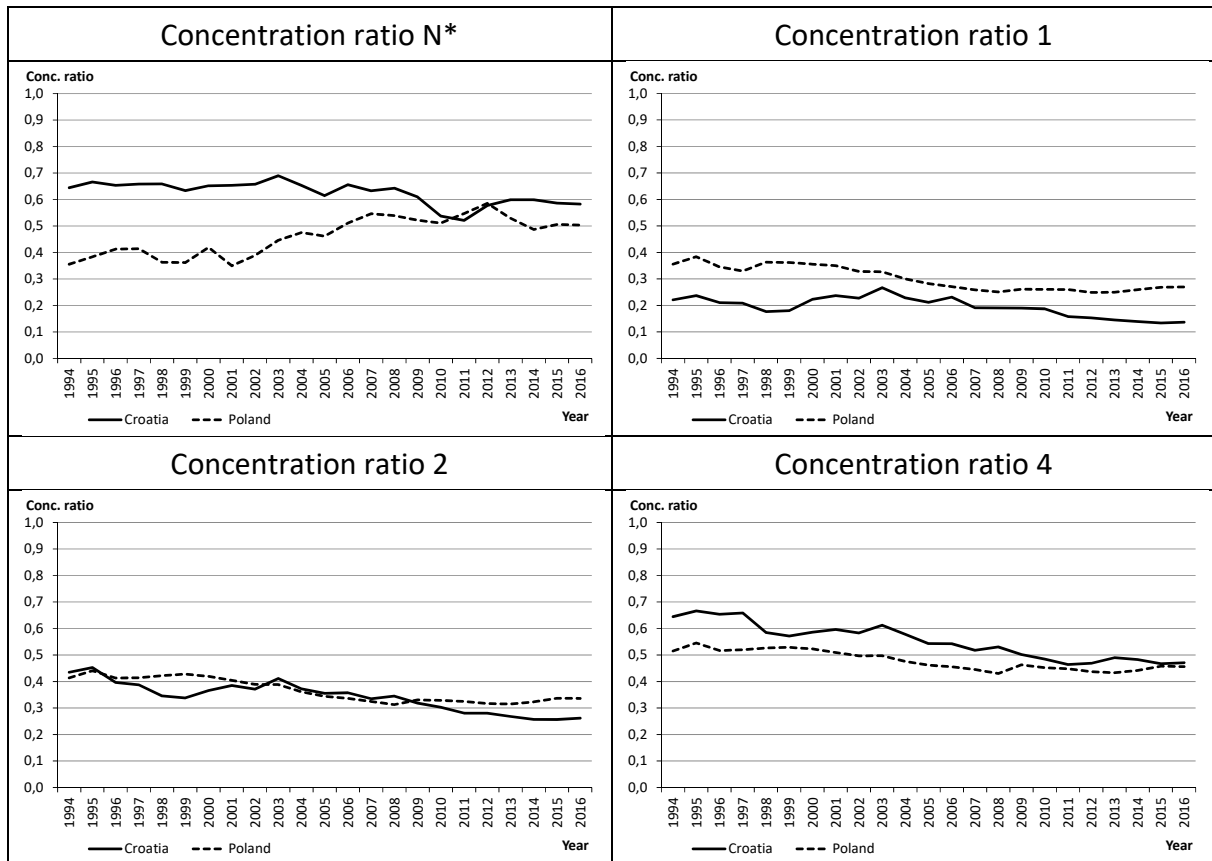


Figure 2: Concentration ratios for Croatia and Poland, export, country level, in period from 1994 to 2016

Note: N is the number of the most important export partners of Croatia and of Poland (see Table 4).

In Figure 3 concentration rates for Croatia and Poland which regard imports at country level are given. The same conclusions, as when exports were observed, can be made. Croatia and Poland are highly dependent on their the most important import partners but Croatia is a little bit more dependent due to higher concentration ratio N values. If only one the most important import partner is observed, concentration ratio 1 values have shown that Poland is more dependable on it than Croatia. Concentration ratios 2 and 4 have shown quite similar concentration levels for both countries in the observed period.

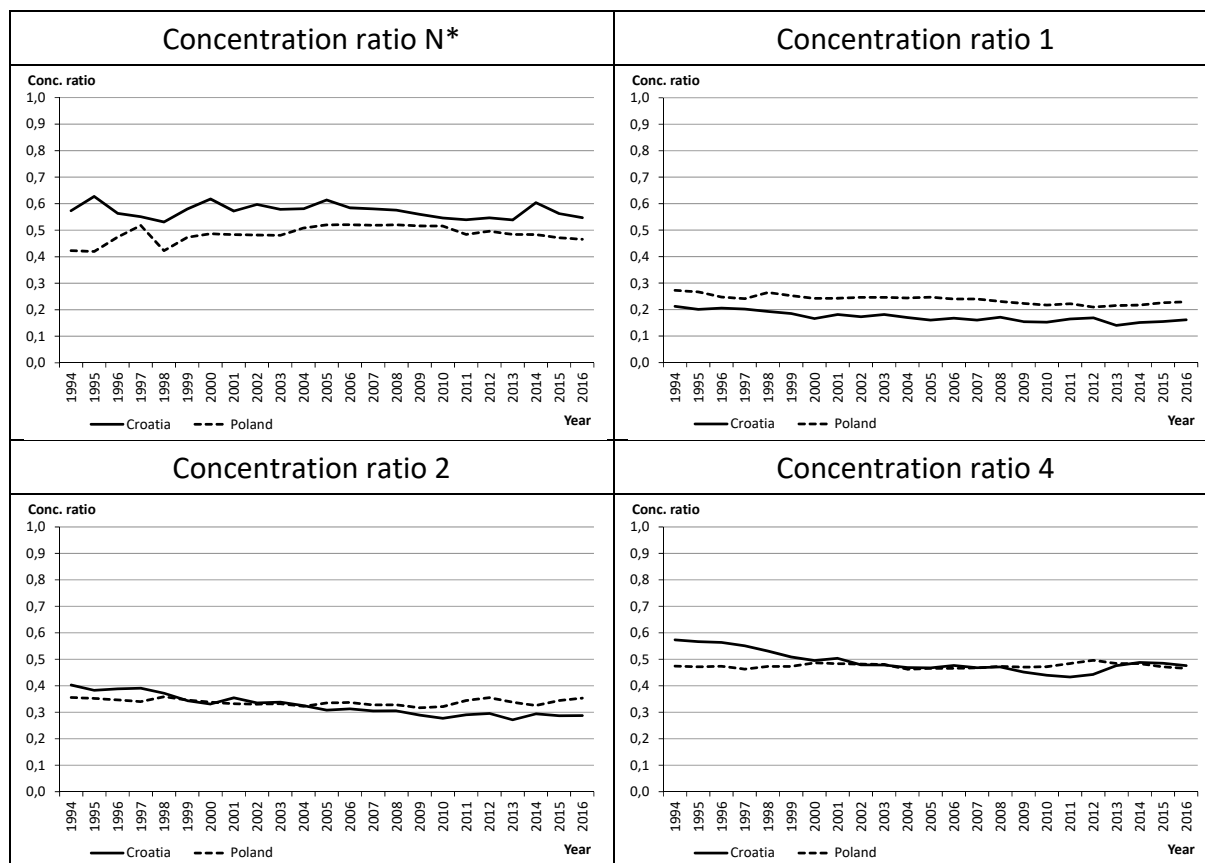


Figure 3: Concentration ratios for Croatia and Poland, import, country level, in period from 1994 to 2016

Note: N is the number of the most important export partners of Croatia and of Poland (see Table 4).

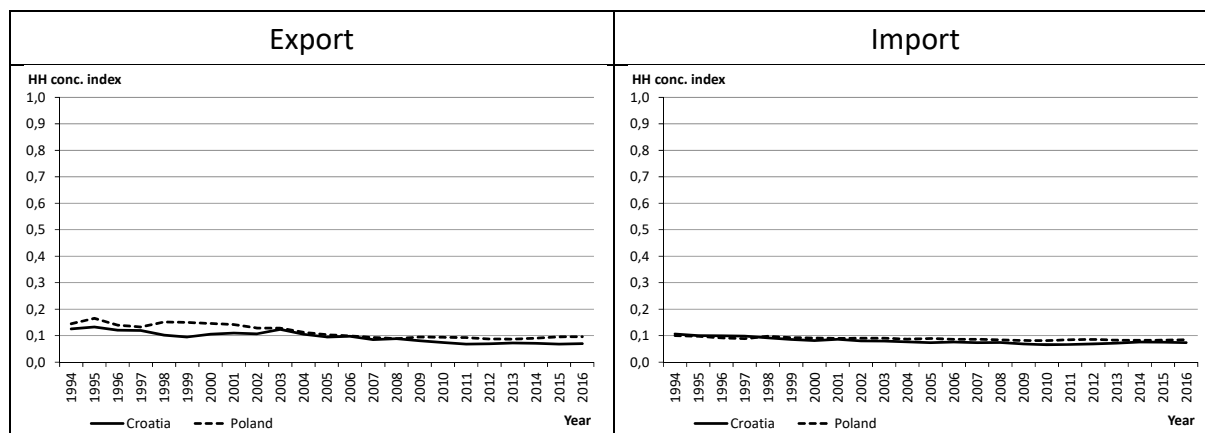


Figure 4: Herfindahl-Hirschman's concentration index for Croatia and Poland, export and import, country level, in period from 1994 to 2016

If total concentration level is observed, it can be concluded that export and import concentration levels in Croatia and in Poland can be treated as low. According to Herfindahl-Hirschman's concentration index values shown in Figure 4 it can be concluded that Croatia and Poland are low trade dependent when all trade partners are taken into account.

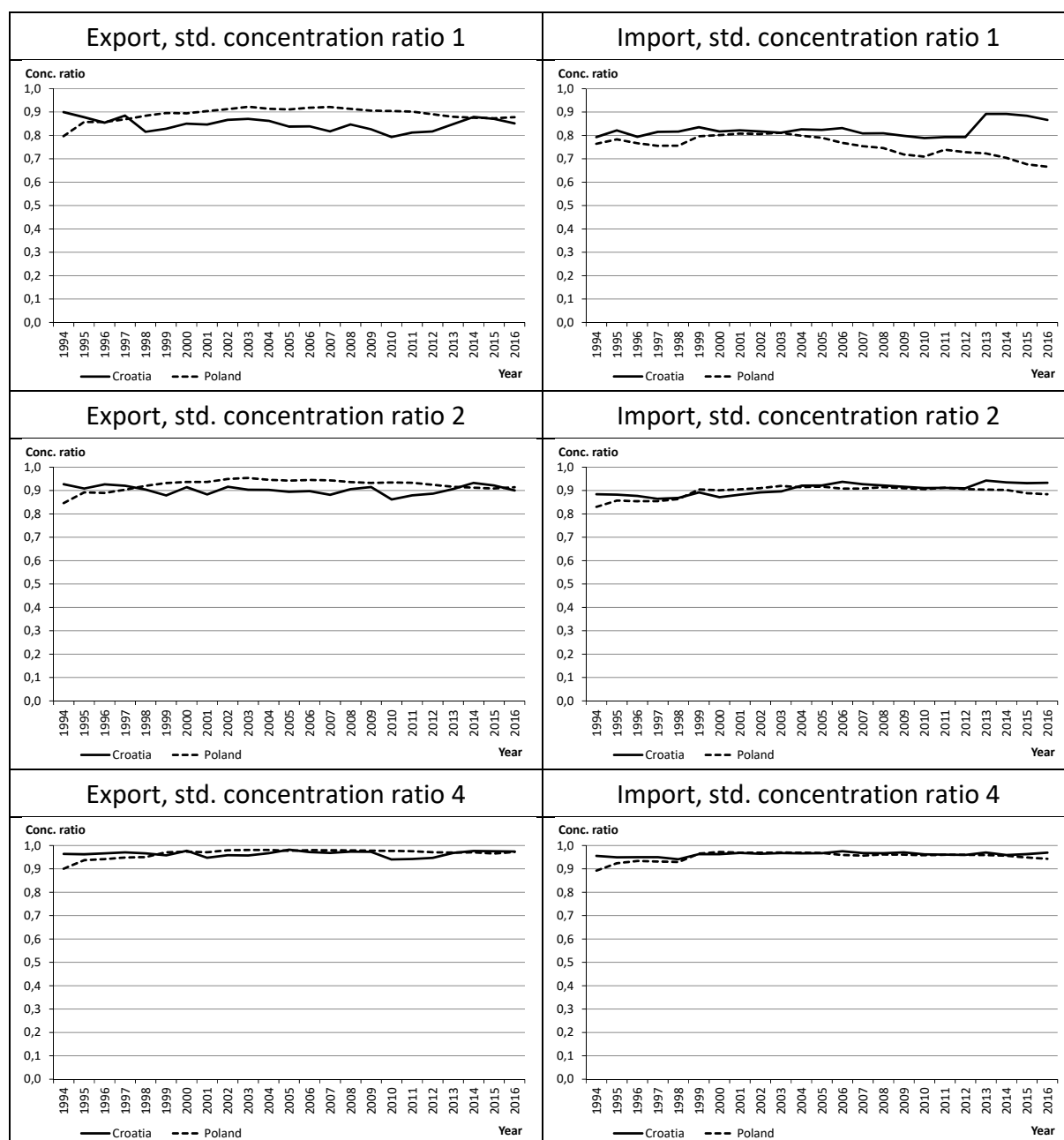


Figure 5: Standardized concentration ratios for Croatia and Poland, export and import, group of countries, in period from 1994 to 2016

Due to large number of observed countries, the difference between unstandardized and standardized ratio values was negligible. Consequently, there was no need to report standardized concentration ratios. However, when the concentration level is inspected on only seven units, that is seven groups of countries, the unstandardized concentration ratio values could be misleading. Therefore, in Figure 5 are shown standardized concentration ratio values regarding exports and imports in Croatia and Poland in the period from 1994 to 2016. In all cases high concentration levels are shown. It can be noticed that both countries, Croatia and Poland, are highly dependable on a trade with some group of countries. If the data are carefully inspected, it can be concluded that the main trading group of countries for Croatia and Poland is consisted of countries from Europe and Central Asia.

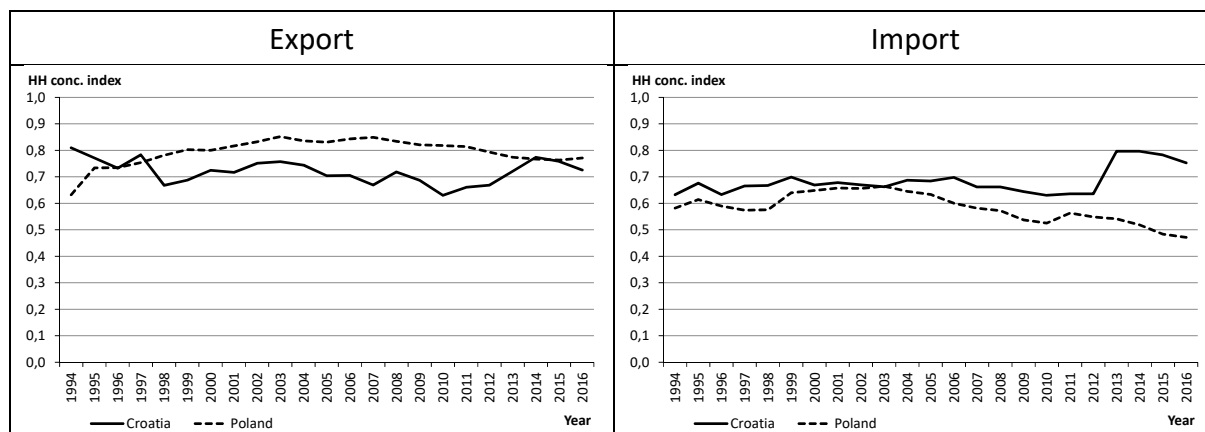


Figure 6: Standardized Herfindahl-Hirschman's concentration index for Croatia and Poland, export and import, group of countries, in period from 1994 to 2016

Standardized Herfindahl-Hirschman's concentration index values, presented in Figure 6, show that Croatia and Poland have high concentration levels regarding export and import as well. That concentration measure confirmed that Croatia and Poland are highly trade dependable on some groups of countries.

Hypothesis of the paper which states that import and export dependence of Croatia and Poland measured by concentration ratios can be treated as low can be accepted in the case when all trade partners were taken into account. Originality and value of paper is using of concentration measures in estimating import and export dependence. This framework could be applied in estimating trade dependence for individual countries other than Croatia and Poland and for group of countries. For example, division could be made on developed and developing countries according to their level of economic development. Results of the analysis can be useful to economic policymakers giving an overall overview of import and export dependence using trade concentration measures. Limitations of research can be related to analysis of only two countries; Croatia and Poland. A more detailed analysis could also include product concentration analysis according to Standard International Trade Classification. Further research in this field should be made including various individual countries and different time periods.

6 Conclusions

Results of the analysis has shown that according to z-score most important Croatian export partners are Italy, Slovenia, Germany, Bosnia and Herzegovina, Austria and Serbia while most important Croatian import partners appear to be Germany, Italy, Slovenia, Austria and Hungary. Most important Poland export partners turned out to be Germany, United Kingdom, Czech Republic, France, Italy and Russia in some years. On the other hand, the most important Poland import partners are Germany, China, Russia, Italy and France. Croatia is highly dependent on its most important export partners with concentration ratio higher than 0.5 in the whole observed period. Poland had lower concentration ratio N values than Croatia. However, in the recent year the concentration ratio N values are about 0.5, which lead to the conclusion that Poland is also highly dependent on its most important export partners. If total

concentration level is observed, it can be concluded that export and import concentration level in Croatia and in Poland can be treated as low. Croatia and Poland are also both highly dependable on a trade with some group of countries, namely Europe and Central Asia.

References

Bikker, J. A., Haaf, K., (2002), *Measures of Competition and Concentration in the Banking Industry: a Review of the Literature*, available at: http://www.dnb.nl/en/binaries/Measures%20of%20Competition_tcm47-145799.pdf [Accessed 26 February 2018].

Dumičić, K., Žmuk, B., Knežević, B., (2017), Concentration Level of the Largest World Retailers Based on Various Concentration Measures as Knowledge Needed by Decision Makers, Lazibat, T., Wach, K., Knežević, B. (eds.) *Growth, Competitiveness and International Trade from the European Perspective*, Zagreb: University of Zagreb, Faculty of Economics and Business, pp. 63-75.

Herfindahl, O. C., (1950), *Concentration in the steel industry*, doctoral dissertation, Columbia University.

Hirschman, A. O. (1980), *National Power and the Structure of Foreign Trade*, Berkeley, University of California Press.

Salomon, S. (2010), *A primer on export diversification: key concepts, theoretical underpinnings and empirical evidence*, Growth and Crisis Unit World Bank Institute May 2010.

Songwe, V., Winkler, D., (2012), Exports and export diversification in Sub-Saharan Africa, A strategy for post-crisis growth, Africa Growth Initiative, available at: <https://www.brookings.edu/wp-content/uploads/2016/06/12-exports-africa-songwe.pdf> [Accessed 26 February 2018].

United Nations (2011), Export dependence and export concentration, United Nations Development Programme, *Towards human resilience: Sustaining MDG progress in an age of economic uncertainty*. Available at: http://www.undp.org/content/undp/en/home/librarypage/povertyreduction/inclusive_development/towards_human_resiliencesustainingmdgprogressinanageofeconomicun.html [Accessed 26 February 2018].

WITS (2018a), *About WITS*, available at: https://wits.worldbank.org/about_wits.html [Accessed 26 February 2018].

WITS (2018b), *Export from Croatia, country level, in thousand US\$, from 1994 to 2016*, available at: <https://wits.worldbank.org/CountryProfile/en/Country/HRV/StartYear/1994/EndYear/2016/TradeFlow/Export/Partner/BY-COUNTRY/Indicator/XPRT-TRD-VL#> [Accessed 26 February 2018].

WITS (2018c), *Export from Croatia, group of countries, in thousand US\$, from 1994 to 2016*, available at: <https://wits.worldbank.org/CountryProfile/en/Country/HRV/StartYear/1994/EndYear/2016/TradeFlow/Export/Partner/BY-REGION/Indicator/XPRT-TRD-VL#> [Accessed 26 February 2018].

WITS (2018d), *Export from Poland, country level, in thousand US\$, from 1994 to 2016*, available at: <https://wits.worldbank.org/CountryProfile/en/Country/POL/StartYear/1994/EndYear/2016/TradeFlow/Export/Partner/BY-COUNTRY/Indicator/XPRT-TRD-VL#> [Accessed 26 February 2018].

WITS (2018e), *Export from Poland, group of countries, in thousand US\$, from 1994 to 2016*, available at: <https://wits.worldbank.org/CountryProfile/en/Country/POL/StartYear/1994/EndYear/2016/TradeFlow/Export/Partner/BY-REGION/Indicator/XPRT-TRD-VL#> [Accessed 26 February 2018].

WITS (2018f), *Import to Croatia, country level, in thousand US\$, from 1994 to 2016*, available at: <https://wits.worldbank.org/CountryProfile/en/Country/HRV/StartYear/1994/EndYear/2016/TradeFlow/Import/Partner/BY-COUNTRY/Indicator/MPRT-TRD-VL#> [Accessed 26 February 2018].

WITS (2018g), *Import to Croatia, group of countries, in thousand US\$, from 1994 to 2016*, available at: <https://wits.worldbank.org/CountryProfile/en/Country/HRV/StartYear/1994/EndYear/2016/TradeFlow/Import/Partner/BY-REGION/Indicator/MPRT-TRD-VL#> [Accessed 26 February 2018].

WITS (2018h), *Import to Poland, country level, in thousand US\$, from 1994 to 2016*, available at: <https://wits.worldbank.org/CountryProfile/en/Country/POL/StartYear/1994/EndYear/2016/TradeFlow/Import/Partner/BY-COUNTRY/Indicator/MPRT-TRD-VL#> [Accessed 26 February 2018].

WITS (2018i), *Import to Poland, group of countries, in thousand US\$, from 1994 to 2016*, available at: <https://wits.worldbank.org/CountryProfile/en/Country/POL/StartYear/1994/EndYear/2016/TradeFlow/Import/Partner/BY-REGION/Indicator/MPRT-TRD-VL#> [Accessed 26 February 2018].

Public Policy

Carlos Jalali

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Empirical Research on the Impact of the Unconventional Monetary Policy Measures of the Leading Central Banks on the Long-term Government Bond Yields by the Interest Rate Transmission Channel

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Abstract: The main purpose of the paper is to conduct an empirical research on the unconventional monetary policy measures implemented by the leading central banks – the US Federal Reserve, Bank of Japan, Bank of England and the European Central Bank, on the long-term government bond yields through the interest rate channel of the monetary transmission mechanism. The research is focused on the changes of the central banks' key interest rates and their effects on the long-term government bond yields of the euro area countries, non-Euro area Member States of the European Union, the United States and Japan. The empirical analysis covers 29 countries explored during the period from January 2010 to December 2016, with the use of monthly data.

Keywords: unconventional monetary policy; interest rate transmission channel; long-term government bond yields

1 Introduction

As a response to the global financial crisis the leading global central banks adopted new monetary policy course deemed as unconventional. They shifted their focus from the standard approach of pursuing inflation and economic growth goals by altering the base interest rates to a wide range of non-standard measures and programs (BIS, 2017, p. 4). The decisive policy easing by the leading central banks during the crisis, and the adoption of unconventional monetary policy measures was crucial in countering the threat of deflation (Orhaphanides, 2010). Low inflation was the main reason behind the implementation of the series of non-conventional measures of the central banks. These measures were also intended to encourage bank lending and economic growth.

The subject of the current research is the unconventional monetary policy of the leading central banks in the world – the European Central Bank (ECB), the US Federal Reserve (Fed), the Bank of England (BoE) and the Bank of Japan (BoJ). The non-standard monetary policy measures, known as quantitative easing (QE), include unprecedented support for the money markets, special credit programs, large-scale asset purchases and forward guidance on the monetary policy path. Against the downturn in the real economy and the deflationary risks,

the short-term interest rates have entered the unexplored negative territory. The lowering of the interest rates into a negative territory became popular in the literature as a Zero interest rates policy (or ZIRP). The impact of those measures extends from the nominal and real interest rates across the yields of different types of financial assets through liquidity-absorbing operations, with the ultimate goal of reaching and enhancing economic activity. While unconventional monetary policy has a direct effect on the key interest rates and consequently on the short-term market rates, its impact on prices of shares, bonds and currencies is indirect.

The key objective of the paper is to explore and assess the impact of the unconventional monetary policy measures on the long-term government bond yields through the interest rate transmission channel. The research methodology covers descriptive study, comparative analysis, systematic approach, empirical (econometric) analysis and critical analysis. Comparative analysis is used for outlining the similarities and differences between central banks' actions on setting the base interest rates and the effects on the government bond yields. Systematic approach is applied in analyzing the interest rates and the government bond yields of the following developed countries – the US, Japan, the UK, the eurozone, and the non-euro area EU Member States, including Bulgaria. Critical analysis is applied about the effects from the unconventional monetary policies, implemented by the leading central banks.

The structure of the paper is as follows: Section 2 describes the scope of the unconventional monetary policy, especially the policy of zero and negative interest rates implemented by the leading global central banks, Section 3 includes a brief literature review on the unconventional monetary policy and its effects on the government bond yields and asset prices, and Section 4 reveals the results from an empirical study on the impact of the non-standard monetary policy on the long-term government bond yields by the interest rate transmission channel. The paper concludes with summarizing the results from the study.

2 Interest rate policy of the leading global central banks

In order to offset the negative effects of the global financial crisis, the world's leading central banks undertake a set of unconventional monetary policy measures, including:

- Lowering and maintaining the key policy rates at zero (ZIRP) or even negative levels (so-called negative interest rate policy, NIRP) on which the paper is focused;
- Experience of actively guiding market expectations through forward guidance;
- Expansion of central bank balances through the purchase of long-term government bonds and risky assets (quantitative easing, QE);
- Introducing various credit easing schemes.

Although the ultimate goal is to achieve and maintain financial and macroeconomic stability, two main objectives of the unconventional monetary policy can be distinguished: first objective – to restore the proper functioning of financial markets and financial intermediation; second objective – to provide additional adjustment monetary policy at low, zero and negative interest rates.

According to Bini Smaghi (2009) the unconventional monetary measures can be defined as a type of policy that is aimed at easing financial conditions. They range from providing additional central bank liquidity to banks to directly targeting liquidity shortages and credit spreads in certain market segments. In general, the unconventional measures directly target the cost and availability of external finance to banks, households and non-financial businesses. These sources of funding may take the form of liquidity provided by the central bank, loans, fixed-income securities or equity.

Under the circumstances of the global financial crisis which was an enormous shock, the four leading central banks were aggressively lowering their key nominal interest rates. While the overnight interest rate in the interbank money market is a target of conventional monetary policy, cutting policy rates to zero, even negative, nominal, is an unconventional measure of monetary policy. With the introduction of nominal interest rates near or below zero, central banks actually lose one of their traditional monetary instruments.

Following the deepening of the financial crisis in autumn 2008, the ECB has implemented a long-lasting and consistent policy to cut its policy rates – the interest rate on its main refinancing operations (MROs), on the marginal lending facility (MLF) and on the deposit facility (DF). By doing this, the ECB follows the Fed's behaviour in significantly reducing key policy rates. From 2008 to December 2015, the Fed keeps interest rate on federal funds close to zero. The overall decline in key ECB interest rates only in 2008 was 175 basis points. In the first five months of 2009, the Governing Council of the ECB reduced the MRO's interest rate by another 150 basis points to 1%. The liquidity facilities corridor was narrowed by 150 basis points, with the ECB's interest rates on MLF and DF down to 0.25% and 1.75%, respectively. In May and November 2013, the ECB cut interest rates on its MROs, on MLF and on DG. However, the Harmonized Index of Consumer Prices (HICP) continued to decrease and inflation was significantly under the ECB's target for inflation of below but close to 2% over the medium term. The low inflation and deflation were the major reasons for the ECB to initiate new measures to lower short-term interest rates and boost bank lending in the eurozone.

At its meeting on November 7, 2013, the Governing Council of the ECB decided to lower interest rates on its MROs to a record low of 0.25% in response to recent signals that the eurozone economy is slowing its recovery from the longest recession in history. The sharp fall in inflation in October 2013 led European central bankers to take the unexpected move in the autumn of 2013. According to Eurostat data, euro area inflation was 0.7% on an annual basis. However, the inflation remained significantly below the level in September 2013 - 1.1% and below the ECB's inflation target.

In 2014, the ECB again lowered its key policy rates. The interest rate on its MROs was cut to 0.15% (by 10 basis points), on the MFL to 0.40% (by 35 basis points), and a negative interest rate of -0.10% (down 10 basis points) was set on the DF. In addition to the DF the negative interest rate applied also to: (i) banks' average reserve holdings in excess of the minimum reserve requirements; (ii) government deposits held with the Eurosystem that exceed certain thresholds; (iii) Eurosystem reserve management services accounts if not currently remunerated; (iv) participants' account balances in TARGET2; (v) non-Eurosystem national

central bank (NCB) balances (overnight deposits) held in TARGET2; and (vi) other accounts held by third parties with Eurosystem central banks when stipulated that they are not currently (at the time the decision was taken) remunerated or are remunerated at the DF rate (BNB, 2014, p. 22).

The revealed stagnation and negative dynamics of the leading economic indicators during the period June–August 2014, formed expectations for a continuous slowdown in the euro area economic activity and a further inflation decline. During the same period the euro area HICP inflation decreased to 0.4% on an annual basis. These data were the major reason behind the additional measures for decreasing interest rates adopted by the ECB at the 4 September 2014 meeting. Interest rates on its MROs and the MLF were decreased by another 10 basis points and the DF rate to -0.20%. On the one hand, the decrease in the DF rate was technical in nature and was intended to sustain the corridor between the rates of the MLF and the DF necessary for the effective money market functioning. On the other hand, a further decrease of MRO rates had a favourable effect on the conditions under which banks may borrow funds through the targeted operations. Overall, from the beginning of the crisis until the end of 2014, the ECB has lowered the interest rate on its MROs 10 times by a total of 395 basis points to 0.05%. In 2015, a change in the interest rate on its MROs was not adopted, but on 10 March 2016 the ECB reduced its key policy interest rates. The interest rate on its MROs was cut to 0%, the interest rate on the DF to its record lowest negative level of -0.40% (by 10 basis points) and the interest rate on the MLF to a level of 0.25% (by 5 basis points). All three interest rate changes took effect from 16 March 2016 and remain unchanged up to present.

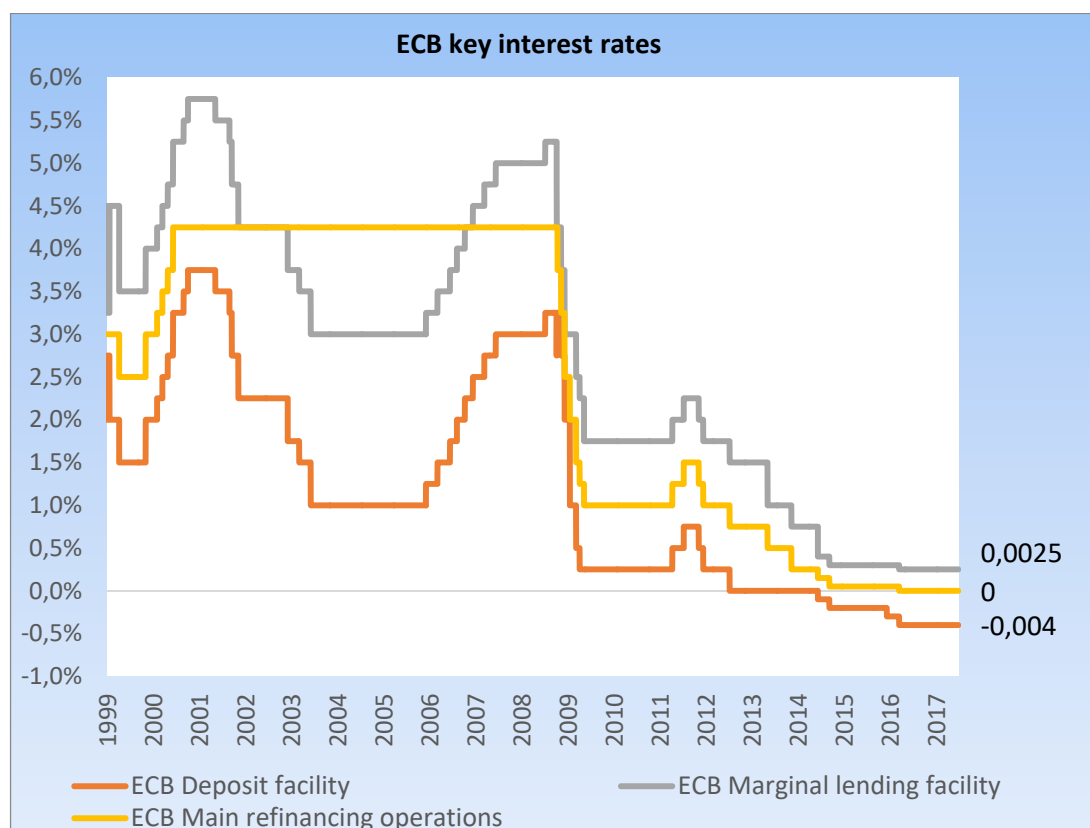


Figure 1: ECB key interest rates

As Draghi (2018a) indicated at the ECB watchers' conference in March 2018, after the end of net asset purchases, the main tool for shaping the ECB's policy stance would become the path of the key policy rates and the forward guidance about their likely evolution. Since 2017 the European economy has continued to recover firmly. The expectations are that the key ECB interest rates will remain at their present levels at least through the summer of 2019, and in any case for as long as necessary to ensure that the evolution of inflation remains aligned with the ECB's forecasts of a sustained adjustment path (Draghi, 2018b).

The Bank of England's Monetary Policy Committee (MPC) sets monetary policy to meet the 2% inflation target, and in a way that helps to sustain growth and employment. On March 5, 2009, the MPC cut the base interest rate to 0.5% and started a quantitative facility with a volume of GBP 375 billion per year to achieve the 2% inflation target. In 2014, when the ECB and other central banks in Europe are lowering their key interest rates and introducing negative rates, the BoE left unchanged its key interest rate at a record low of 0.50%. It remained unchanged until August 2016, when the BoE introduced new monetary policy measures to provide additional support to the British economy in connection with the UK's exit from the EU after the referendum in June 2016. Rather than being among the first leading central banks in developed countries to raise the base interest rate, the BoE was doing the opposite – lowering the official interest rate to 0.25%. This measure was short-term, since at the end of 2017, the BoE again returned the base interest rate to a level of 0.50%. At its meeting ending on 9 May 2018, the MPC voted to maintain the Bank Rate at 0.50%.

There had been little news on monetary policy in the euro area and the United States (BoE, 2018, p. 1): On April, 26, 2018 the ECB Governing Council had left interest rates and asset purchases unchanged, in line with expectations. On 2 May, the Fed had left the federal funds rate unchanged. Market pricing had continued to imply a high likelihood of a 25 basis point increase at the June FOMC meeting, and for the federal funds rate to rise to around 2.50% by the end of 2019. At longer maturities, 10-year US Treasury yields had continued to pick up, exceeding 3% for the first time since 2014.

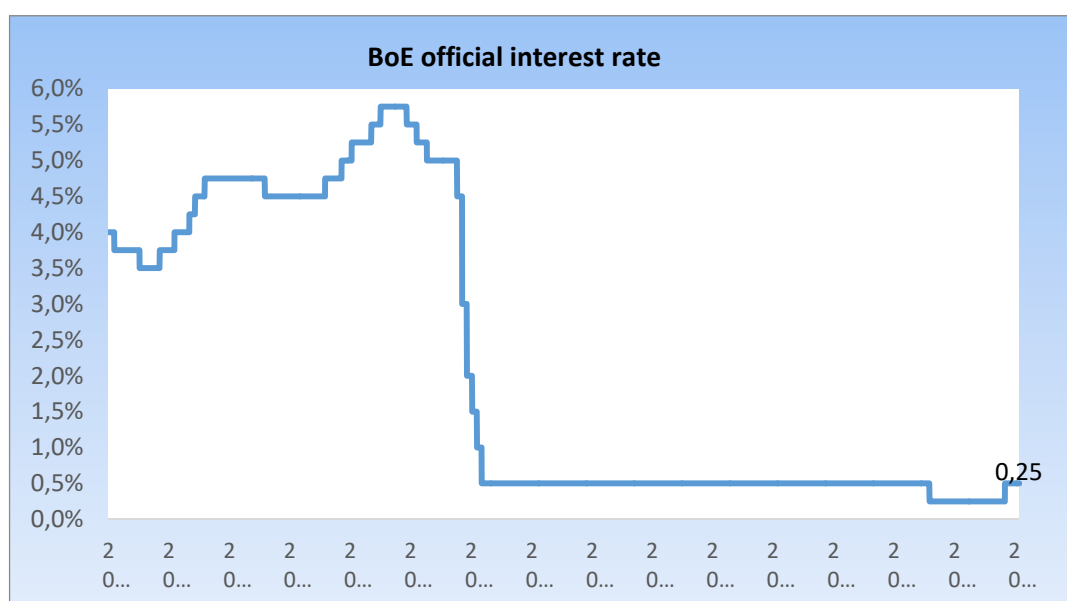


Figure 2: BoE official interest rate

Developments regarding the United Kingdom's withdrawal from the EU – and in particular the reaction of households, businesses and asset prices to them – remain the most significant influence on, and source of uncertainty about, the economic outlook. In such exceptional circumstances, the MPC's must balance any significant trade-off between the speed at which it intends to return inflation sustainably to the target and the support that monetary policy provides to jobs and activity.

With the onset of the global financial crisis, the Fed's Federal Open Market Committee (FOMC) lowered the interest rate on federal funds ten times. From 5.25% at the end of August 2007, it was lowered to 0.25% in December 2008. Federal funds rate remained at this level over the period of 8 years before the Fed raised it to 0.50% in December 2015. In December 2016, the FOMC raised the target for the federal funds rate to a range of 0.50% to 0.75% after maintaining it at 0.25% to 0.50% for a year. The decision to increase the federal funds rate reflected realized and expected labor market conditions and inflation. Over the first half of 2017, the FOMC continued to gradually reduce the amount of monetary policy accommodation. Specifically, the Committee decided to raise the target range for the federal funds rate in March and in June, bringing it to the current range of 1.00% to 1.00-0.25% (FRS, 2017). Even with these rate increases, the stance of monetary policy remains accommodative, supporting some further strengthening in labor market conditions and a sustained return to 2% inflation.

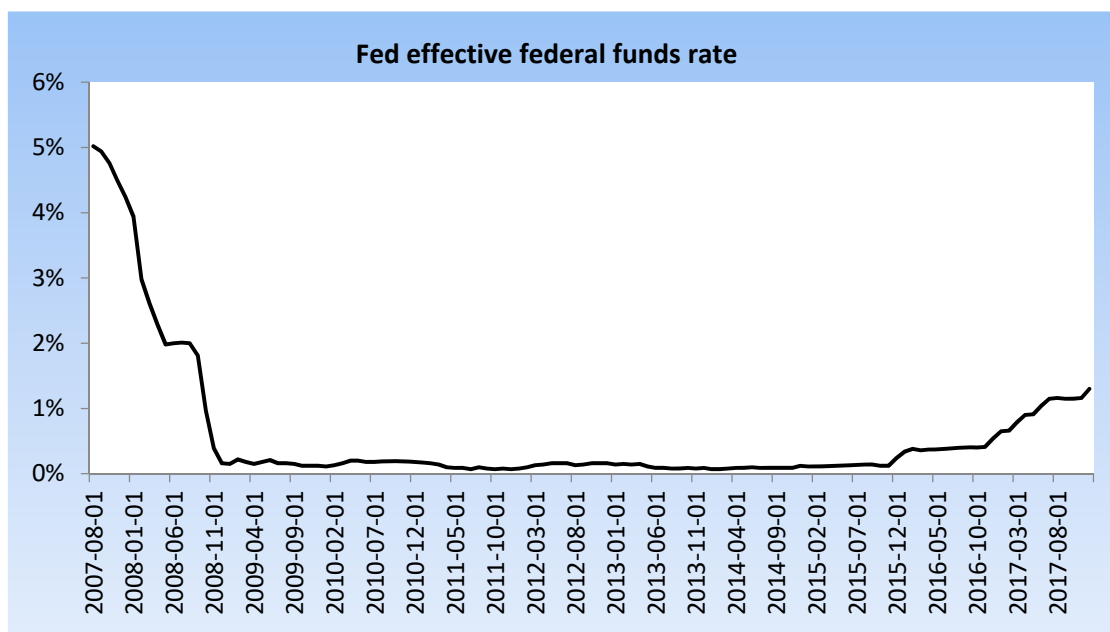


Figure 3: Fed effective federal funds rate

Following the global financial crisis, the BoJ lowered its base interest rate from 0.50% to 0.30% in October 2008 and then to 0.10% in December 2008. In 2010, the key interest rate was lowered to zero and remained at this level for about five years. In this way, the BoJ was the first central bank to hold the zero-level base rate in practice for so long. It remained at this level until January 2016, when the BoJ introduced a negative rate of -0.10%, which is still in

force. It applies to the current accounts that financial institutions hold at the BoJ, which are accrued at three intervals by + 0.10%, 0% and -0.10% respectively, depending on the outstanding balance of each financial institution's current account at the BoJ (BoJ, 2016, pp. 5-6).

With regard to conducting monetary policy, as appropriate has been defined the following guideline for the BoJ's short-term policy interest rate – applied negative interest rate of -0.10% to the policy-rate balances in current accounts held by financial institutions at the BoJ. As for the long-term interest rate, the BoJ is planning to purchase Japanese government bonds (JGBs) so that 10-year JGB yields would remain at around 0% (BoJ, 2018, p. 20).

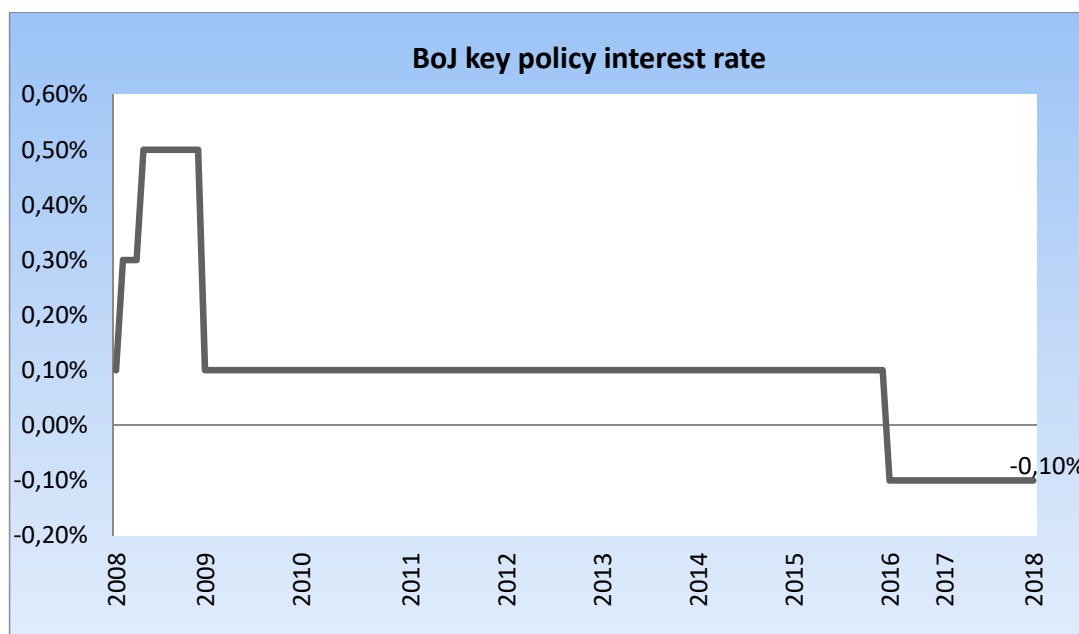


Figure 4: BoJ key policy interest rate

As concerns the policy of negative nominal interest rates, from 2012 to 2016, central banks in Switzerland, Sweden, Denmark, Japan, and the euro area reduced their key policy rates below zero for the first time in economic history. (Eggertsson et al., 2018). As it is mentioned, the first is the ECB, after reducing the interest rate on the deposit facility to -0.10% on 11 June 2014. The Bank of Denmark is the next to change the interest rate on deposit certificates from + 0.05% to -0.05% on September 5, 2014. For short, the Bank of Denmark maintains negative interest rates on deposit certificates from mid-2012 to April 2014. On 18 December 2014, the Swiss Central Bank also announced the introduction of a negative interest rate directly applicable from 15 January 2015 on deposits with the central bank above a certain limit in an attempt to protect the Swiss franc from appreciation. Subsequently, on February 18, 2015, the Bank of Sweden lowered the base rate on repo operations to -0.10%, after using the negative interest rates for the period 2009-2010 in line with the interest rate policy. Japan becomes the first Asian country whose central bank introduces a negative interest rate. The rate announced by the BoJ on January 29, 2016 was -0.10%. As can be seen from Table 1 the measures of the central banks are not one-off.

Table 1: Interest rate decisions of the world's leading central banks during the period 2014-2016

Country	Aim	Instrument	Interest rate	Date of introduction
Bosna and Herzegovina	Transferring the monetary policy of the ECB, avoiding potential losses for the central bank	Interest rate on excess reserves	-0,20% <i>(50% of the interest rate on the ECB's deposit facility shall apply)</i>	1 July 2016
Bulgaria	Transferring the monetary policy of the ECB, avoiding potential losses for the central bank, is not introduced as a monetary policy instrument because of the currency board	Interest rate on excess reserves	-0,30% -0,40% -0,60% <i>(according to BNB Ordinance No. 21, the interest rate on the ECB deposit facility)</i>	4 January 2016 16 March 2016 1 October 2017
Denmark	Obstruction of purchases of local currency from abroad due to its characteristic of asset haven, protection of the currency from appreciation	Deposit certificates	-0,20% -0,10% +0,05% -0,05% -0,20% -0,35% -0,50% -0,75% -0,65%	July 2012 January 2013 April 2014 September 2014 19 January 2015 22 January 2015 29 January 2015 5 February 2015 8 January 2016
Euro area	Price stability and guidance of inflation expectations (together with an extended asset purchase program)	Deposit interest rate	-0,10% -0,20% -0,30% -0,40%	11 June 2014 10 September 2014 9 December 2015 16 March 2016
Norway	Price stability	Reserve interest rate	-0,25% -0,50%	24 September 2015 17 March 2016
Hungary	Price stability and countering the appreciation of the local currency (together with a small-scale asset purchase program)	Deposit interest rate	-0,05%	23 March 2016
Switzerland	Countering the local currency appreciation after the abolition of the upper bound of the Swiss franc exchange rate against the euro and the deflationary pressure	Deposits with the central bank with a margin to which an exception applies	-0,75%	15 January 2015
Sweden	Price stability and guidance of inflation expectations (together with a small-scale asset purchase program)	Interest Rate on Repo Operations	-0,10% -0,25% -0,35% -0,50%	12 February 2015 18 March 2015 2 July 2015 11 February 2016
Japan	Price stability and guidance of inflation expectations (together with an asset purchase program)	Reserve interest rate (in three levels)	-0,10%	16 February 2016

Source: Central banks, Bank for International Settlements

3 Brief literature review on the unconventional monetary policy and its effects on the government bond yields and asset prices

Broad consensus exists in the literature on unconventional monetary policy that the measures aimed at increasing the central bank balance sheets are likely to lead to a decline in long-term government bond yields and a rise in asset prices. A bulk of these studies is focused on the influence of the QE on financial markets in the US and in the euro area. Bini Smaghi (2009) analyzes how the non-conventional monetary measures are implemented in the euro area and how can the size and composition of the central bank balance sheet be modified by using direct QE, direct credit easing and indirect (or endogenous) quantitative/credit easing. He concludes that, given the importance of the banking channel in providing credit to the economy, the unconventional policy measures that best suit the euro area are likely to differ in terms of scope and depth from those in the US or other advanced economies where a more market-based financial system prevails.

The majority of studies on the macroeconomic impact of unconventional monetary policy measures on macroeconomic variables use a form of autoregressive vector (VAR) models. One of the first studies on this matter is that of Baumeister and Benati (2010, p. 23). Their main conclusions are that the asset purchases conducted by the leading central banks had a powerful impact on output growth and inflation and that monetary policy measures helped to avoid deflation and output collapses similar to the Great Depression. The same type of model is used by Lenza et al. (2010) to assess the macroeconomic impact of unconventional measures in the euro area. Their general conclusion is that the measures adopted after the collapse of Lehman Brothers were important in stabilizing the real economy, but not sufficient to avoid a fall in economic activity in the eurozone. Moreover, the authors point out that studies about the effectiveness of the non-conventional monetary policy rely on different methodologies and data frequencies but generally conclude that the asset purchases had a positive but short-lived effect on market functioning by reducing liquidity premia and lowering the level as well as the volatility of yields (Lenza et al., 2010, p. 32).

Gagnon (2011) applies an event-study approach for assessing the effects from the unconventional monetary policy on the yield on the US Treasuries after Fed announcements. Also, Gagnon et al. (2015) give attention to changes in the US dollar exchange rate before and after similar announcements by the Fed, but expands the study with an analysis of the impact of the news on the exchange rates and emerging market bond yields by looking at the current accounts of balance of payments of the countries affected by those effects. The event-study approach showed that changes in the 10Y US government bond yields on the prices of foreign financial assets coincide with the belief that the good news about US economic activity are good for the other countries as well. It is concluded that the potential shocks from the Fed's monetary policy had only a small effect on the foreign currencies, which, according to Gagnon et al. (2015) are the main channel through which the US monetary policy may affect the current account balances of other countries.

Some researches highlight the differences of the effects across euro area Member States and the spreads between the yields on their government bonds. For example, Falagiarda and Reitz (2015, pp. 276-295) are focused on the effects on the spread between euro area sovereign

bonds by analyzing more than 50 messages by the ECB (press conferences, press releases and speeches) between January 2008 and September 2012. They found that the ECB's statements reduced the spreads between the German bond yields and the government bond yields of Spain, Italy, Ireland, Portugal, but not the Greek one. Expanding the time frame, used by Fratzscher et al. (2016, pp. 36-74), Briciu and Lisi (2015) took the effects from seven ECB's programs and measures, implemented between October 2008 and January 2015, on the financial sector and financial conditions as a whole. One of the main conclusions was that the Asset Purchase Programme (APP) of the ECB, announced in January 2015 and started in March 2015, had a significant impact on the exchange rate of the euro and also it contributed to the lowering of the long-term government bond yields of the countries included in the analysis. For example, the announcement of the APP weakened the EUR/USD exchange rate by 3,5%, the EUR/JPY exchange rate by 3,66% and the EUR/GBP rate by 2,48%. The impact on long-term government bond yields varies depending on the announced programme. However, the trend was that after the news of a new measure the bond yields of the peripheral euro area Member States declined and that of the countries in the core Member States increased. For example, the announcements led to a decline of up to 66 basis points in the yields on the 10Y government securities of Italy and Spain, but after certain statements there was also a decline of up to 40 basis points. On the other hand, the yield on German 10Y government bonds increased by up to 34 basis points, but also decreased by up to 17 basis points in certain cases.

According to Williams (2014) who analyzed 14 previous studies, the QE program for asset purchases with a volume of 1 trillion US dollars led to a fall in the yield on the 10-year US government bonds by between 30 and 300 basis points and the average effect was a drop of around 40 basis points. According to Chung et al. (2012, pp. 47-82) and Gürkaynak et al. (2005, pp. 55-93) who compared the 40 basis point yield drop, induced by the QE, with the conventional monetary policy, such effects would be achieved by reducing the key interest rate by between 1,5 and 1,75 percentage points (p.p.). Andrade et al. (2016) observed the effects from the ECB's APP. Their general conclusion is that there are significant and continuous effects from the APP on the government bond yields and on prices of shares issued by those banks having significant share of government securities in their balance sheets. The authors used a general equilibrium model and compared the effects from the APP with unconventional monetary policy measures. They concluded that the APP had effect, similar to a 100 basis points decline of the base interest rate. However, Gambacorta et al. (2012, p. 1) conclude that it is challenging to find an appropriate econometric model to analyze the macroeconomic effects of central banks' measures aimed at increasing their balance sheets in times of crisis when the interest rates reach the zero lower bound. D'Amico and King (2010), Doh (2010), Gagnon et al. (2010, 2011), Joyce et al. (2011), Krishnamurthy and Vissing-Jorgensen (2011, 2014) and Meaning and Zhu (2011, 2012) calculate the effects from the Fed's and the BoE's asset purchase programs. Studies for Japan, like Ugai (2015, pp. 1-48), for example, also showed that the QEs have led to a decline in government bond yields.

In Bulgaria the main publications on on unconventional monetary policy are those by the Bulgarian National Bank (BNB) (2014, 2015, 2016) focused mostly on the process of monetary policy normalization in the US and the non-standard monetary policy measures taken by the ECB, including the ECB's Public Sector Purchase Programme (PSPP).

4 Empirical study of impact of the unconventional monetary policy of the leading central banks on the long-term government bond yields by the interest rate transmission channel

In this section an empirical study on the dynamics and the relationships between key interest rates and interest rates on long-term Treasury securities issued by governments of the euro area members, non-euro area EU Member States, the United States and Japan, is made. The empirical analysis covers 29 countries totally. The reviewed period is from January 2010 to December 2016, by using monthly data (end of month), including totally 84 observations.

The methodology, applied in the current study, includes econometric modeling by using EViews statistical software () for the empirical study for assessment of the impact of the interest rates transmission channel on the long-term government bond yields of the investigated 29 countries. The constructed linear econometric model is as follows:

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 t + \varepsilon_t + \varepsilon_{t-1} + \varepsilon_{t-2},$$

where:

Y_t (dependent variable) is the yield on long-term government bonds,

X_t is the independent variable for the base interest rate,

t is for the time as another independent variable,

ε_t is for the residual component.

Linear least squares regression method is used. The adequacy of the constructed econometric model is confirmed by using the F-test–Prob (F-statistic). The model is adequate when the F-test–Prob (F-statistic) < α , where $\alpha = 0,05$. Also, the explanatory power of the model is demonstrated (as measured by R^2). It shows how many percents of the yield changes on the euro area long-term government bonds can be explained by the changes in the two studied factors – the base interest rate and the time.

Moreover, a test for serial autocorrelation in residuals as well as for the type of residuals distribution is made with a view to ensure quality of the obtained results. The test for serial autocorrelation demonstrates whether autocorrelation exists in the residual component ε_t . This is done by calculating the autocorrelation coefficients and by constructing the autocorrelogram of ε_t (shown in Appendix № 2 for all examined countries).

4.1 Impact of the interest rates changes on the long-term government bond yields in the euro area countries

This section is dedicated to the empirical research on the dynamics and the relationships between the key interest rates and the bond yields, issued by the governments of the euro area Member States – Austria, Belgium, Germany, Greece, Ireland, Spain, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, Finland and France. With this regard, econometric models for each euro area Member State (excluding Estonia)

are constructed. For Estonia no econometric model is developed because of the lack of relevant statistical data. Accordingly, totally 18 euro area Member States are covered in the empirical analysis. The studied period is from January 2010 to December 2016, by using monthly data (end of month), including totally 84 observations. Again the linear least squares method is used.

The yield on the long-term government securities of the euro area Member States in the developed econometric model is presented as the dependent variable Y_t , and the factor variables are Euro OverNight Index Average (EONIA), denoted by X_t , and the time t . As an interest rate factor, the EONIA was chosen, since the initial test by using the ECB's interest rate on its MROs did not achieve reliable results.

The aggregated results from the constructed econometric models for the euro area Member States demonstrate that between 94% and 98% of the changes in the yield of the long-term government bonds can be explained by the changes in the EONIA levels and over time. The EONIA and the time for one third of the cases are not statistically significant (Table 2). There are several reasons behind this conclusion, among which:

- Malfunctioning of the interbank money market in the euro area as a result of the financial and the consequent debt crisis in Europe, experienced during the observed period 2010-2016.
- Lack of sufficient and active supply of funds in the euro area interbank money market;
- High liquidity of the euro area credit institutions, which do not need to attract funds through the interbank market, which leads to a lower demand.
- Traditionally low levels of EONIA, including their passing on the territory of the negative interest rates.
- Loans provided by the ECB to the euro area credit institutions at very low and zero interest rates through its specific credit programmes.
- Quantitative easing, implemented by the ECB, which traditionally is based on purchases of long-term government bonds of the euro area Member States in the secondary market, which over time have had an impact on the government bond yields towards their reduction. The QE has twofold effects: first, sovereign yields serve as a benchmark for pricing riskier privately issued securities. When long-term government bonds are purchased, the yields on privately issued securities are expected to decline in parallel with those on government bonds. Second, if long-term interest rates begin to fall, this can stimulate longer-term investments and hence aggregate demand, thereby supporting price stability.
- Results from the econometric modeling demonstrates that during the observed period the time had no statistically significant impact on the government bond yields of Greece, Cyprus, Spain, Ireland, Portugal and Slovenia – countries among the hardest hit by the eurozone debt crisis, with limited access to the international capital markets, especially Greece, for example.

The results from the econometric models also demonstrate that, at EONIA fixed values, the long-term government bond yields of the euro-area Member States would fall in the range of -0,13 to -0,050 p.p. on a monthly basis. The summarized results are shown in Table 2.

Table 2: Summarized results from the constructed econometric models for the euro area Member States

Country/ Criteria	% from the changes in the long-term government bond yields, explained by EONIA and the time	Statistically significant impact of EONIA	Statistically significant impact of the time	At EONIA fixed rates every month the long- term government bond yields are expected to decline by (p.p.)
Austria	98%	NO	YES	-0,042758
Belgium	98%	NO	YES	-0,046402
Germany	98%	NO	YES	-0,03378
Greece	90%	NO	NO	-
Estonia	Econometric model is not constructed because of the lack of relevant statistical data			
Ireland	97%	NO	NO	-
Spain	97%	NO	NO	-
Italy	97%	NO	YES	-0,040361
Cyprus	94%	NO	NO	-
Lithuania	98%	NO	YES	-0,132704
Litva	97%	NO	YES	-0,077393
Luxembourg	98%	NO	YES	-0,040185
Malta	99%	NO	YES	-0,048397
Netherlands	98%	NO	YES	-0,034371
Portugal	97%	NO	NO	-
Slovakia	98%	NO	YES	-0,048351
Slovenia	97%	NO	NO	-
Finland	98%	NO	YES	-0,034428
France	98%	NO	YES	-0,038828

Source: own calculations

4.2 Impact of the interest rates changes on the long-term government bond yields in the non-euro area EU Member States

In this section the results from the elaborated empirical study on the dynamics and the relationships between the key interest rates and the bond yields, issued by the governments of the EU Member States, which are not euro area members, are presented. Such countries are– Bulgaria, Denmark, the United Kingdom, Poland, Romania, Croatia, the Czech Republic and Sweden. The observed period spreads from January 2010 to December 2016, by using monthly data (end of month), including totally 84 observations.

The yield on long-term government securities of the non-euro area EU Member States in the developed econometric model is presented as the dependent variable Y_t , and the factor variables are EONIA, denoted by X_t , and the time t .

In the case of Bulgaria, the factor for the interest rate is the Base Interest Rate, as measured by the index LEONIA. The LEONIA (LEv OverNight Index Average) reference rate is produced in the period between December 2004 and end-June 2017, and published by the BNB. The first reference rate was published on 1 December 2004. As of 1 July 2017 the calculation of LEONIA is discontinued, and its last value is published on 30 June 2017. As of 1 July 2017, the LEONIA Plus reference rate replaces the LEONIA reference rate as an effective overnight rate computed as a weighted average of all overnight unsecured lending transactions in the interbank market in Bulgaria and as a basis for calculating the Base Interest Rate.

The aggregated results from the constructed econometric models for the non-euro area EU Member States show that between 95% and 98% of the changes in the yield of the long-term government bonds can be explained by the changes in the EONIA levels and over time. The results also show that at EONIA fixed levels the yield on long-term government bonds can drop from -0,025 to -0,068 p.p. on a monthly basis. The summarized results are shown in Table 3.

Table 3: Summarized results from the constructed econometric models for the non-euro area EU Member States

Country/ Criteria	% from the changes in the government bond yields, explained by EONIA and the time	Statistically significant impact of the Base Interest Rate/EONIA	Statistically significant impact of the time	At Base Interest Rate/EONIA fixed rates every month the government bond yields are expected to decline by (p.p.)
Bulgaria	97%	YES	YES	-0,042758
United Kingdom	95%	NO	YES	-0,025173
Denmark	97%	NO	YES	-0,033975
Poland	97%	NO	YES	-0,041581
Romania	97%	NO	YES	-0,067108
Hungary	97%	NO	YES	-0,068021
Croatia	97%	NO	YES	-0,042687
Czech Republic	98%	NO	YES	-0,049697
Sweden	97%	NO	YES	-0,030479

Source: own calculations

4.3 Impact of the interest rate changes on the long-term government bond yields in the US and Japan

The empirical research continues with the constructed econometric models for the US and Japan. First, a model is constructed for the relationship between the US federal funds rate and the yield on the US long-term government bonds. The yield on the US long-term Treasuries is

presented as the dependent variable Y_t , and the factor variables are the federal funds rate, denoted by X_t , and the time t .

The obtained results are the following: (1) It can be assumed that the developed econometric model is adequate which is confirmed by the F-test–Prob (F-statistic) $< \alpha$, where $\alpha = 0,05$. (2) The model has a very high explanatory power - $R^2 = 0,9$, which means that 90% of the changes in the yield on the US long-term Treasuries can be explained by the changes in the two factors – the federal funds rate and the time. (3) The time has a statistically significant impact since the level of significance (prob.) is quite lower than the assumed risk of error ε_t , but the federal funds rate has no impact. (4) The test for serial autocorrelation shows that the first autocorrelation coefficients have small values and are not statistically significant. Since one of the parameters in front of the factors can be considered statistically significant, it can be interpreted.

From the obtained results, the following two conclusions can be made for the US federal funds rate: (1) The levels of the federal funds rate did not have a statically significant impact on the yield on the US long-term Treasuries during the period January 2010 - December 2016. (2) At fixed levels of the federal funds rate each month the interest rate on the long-term US Treasuries is expected to decrease by 0,015584 p.p.

As concerns the BoJ, it conducts unconventional monetary policy for almost two decades, which underlines its significance for the economic recovery. In the model, constructed for Japan, the Japanese long-term government bond yield is presented as the dependent variable Y_t , and the factor variables are the BoJ's policy rate, denoted by X_t , and the time t . The following results are made: (1) It can be assumed that the developed econometric model is adequate. This is confirmed by the F-test–Prob (F-statistic) $< \alpha$, where $\alpha = 0,05$. (2) The model has a very high explanatory power - $R^2 = 0,98$, i.e. 98% of the changes in the long-term Japanese government bond yield can be explained by changes in the two factors – the BoJ's policy rate and the time. (3) The BoJ's policy rate and the time have a statistically significant impact since the level of significance (prob.) is quite lower than the assumed risk of error ε_t . (4) The test for serial autocorrelation in the residual component ε_t demonstrates that the first autocorrelation coefficients have small values and are not statistically significant. Since the two parameters in front of the factors can be considered statistically significant, they can be interpreted.

From the obtained results, the following conclusions can be drawn for the BoJ's policy rate: (1) The levels of the BoJ's policy rate have statistically significant impact on the long-term Japanese government bond yields. *Ceteris paribus*, an increase of the policy rate by 1 p.p. can lead to a rise in the yield by 0,71 p.p. (2) At fixed levels of the BoJ's policy rate each month the yield on long-term Japanese government bonds is expected to decline by 0,014950 p.p.

5 Conclusion

Building econometric models that can be used to assess the impact of the unconventional monetary policy measures on the long-term government bond yields requires special attention both from academics and professionals. Such models recognise the significant role of the interest rate transmission channel. The applied empirical study on the impact of the

changes in central bank key policy rates on the long-term government bond yields of the euro area countries, non-Euro area Member States of the EU, the US and Japan (totally 29 countries observed) during the period from January 2010 to December 2016 reveals the following main conclusions.

In some reviewed countries, changes in the key interest rates and the time have a statistically significant impact on the long-term government bond yields. In other countries – changes in the key policy rates and the time do not have a significant impact. Overall, *ceteris paribus*, depending on the country under review by increasing the interest rates by 1 p.p. or at fixed levels each month the long-term government bond yields would change in the range of -0,02 to 0,7 p.p.

As concerns the euro area Member States only – at fixed interest rates, yields on long-term government bonds would fall in the range of -0,13 to -0,050 p.p. monthly. For some of the countries hit hardest by the debt crisis, such as Greece, Cyprus, Spain, Ireland and Portugal, EONIA and the time have no significant impact on the yield on their long-term government securities. For Italy alone, the yield on its government bonds would decline by -0,04 p.p.

For the non-euro are EU Member States, 1 p.p. increase in the key policy rates would lead to a change in the long-term government bond yields in the range of -0,068 to -0,025 p.p. Only in Bulgaria at fixed levels of the Base Interest Rate, each month the interest rate on the long-term government securities is expected to decrease by 0,04 p.p. In addition, it can be said that the Base Interest Rate and time have a statistically significant impact in Bulgaria.

For the United States and Japan, an increase of the interest rates by 1 p.p. would lead to a change in the yield on their long-term bonds by -0,016 and +0,71 p.p., respectively.

The latest decisions of the ECB indicate signals for policy normalization. In June 2018 the ECB's Governing Council voted to end the QE programme in December 2018 but to keep interest rates at record lows for a long time. In fact, the ECB has bought more than EUR 2 trillion of government bonds by its huge bond-buying programme. Moreover, the ECB will reduce the purchases of assets to EUR 15 billion a month after September 2018 and to end completely at the end of the year.

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References

Andrade et al. (2016), "The ECB's asset purchase programme: an early assessment", *ECB Working Paper* No. 195, European Central Bank, Frankfurt am Main.

Baumeister and Benati (2010), "Unconventional monetary policy and the Great Recession. Estimating the impact of a compression in the yield spread at the zero lower bound", *ECB Working Paper* No. 1258, European Central Bank, Frankfurt am Main, October.

Bini Smaghi (2009), "Conventional and unconventional monetary policy", European Central Bank, Keynote lecture at the International Center for Money and Banking Studies (ICMB), Geneva, Switzerland, 28 April.

BIS (2017), "Global impact of US and euro area unconventional monetary policies: a comparison", *BIS Working Papers*, No. 610, Bank for International Settlements, Basel, February.

BNB (2014), "The Effect of ECB Monetary Policy Measures in 2014 on the Euro Area Financial Market and Bulgaria's Banking System", *Economic Review*, Vol. 3/2014, Bulgarian National Bank, Sofia.

BNB (2015), "Monetary policy normalization in the US", *Economic Review*, Vol. 4/2015, Bulgarian National Bank, Sofia.

BNB, "Details on the ECB's PSPP", *Economic Review*, Vol. 1/2015, Bulgarian National Bank, Sofia.

BoE (2018), Monetary Policy Summary and minutes of the Monetary Policy Committee meeting ending on 9 May 2018, Bank of England, London, 10 May.

BoJ (2016), *Introduction of quantitative and qualitative monetary easing with a negative interest rate*, Press release, Bank of Japan, 29 January.

BoJ (2018), Minutes of the Monetary Policy Meeting on April 26 and 27, 2018, Bank of Japan, 20 June.

Briciu and Lisi (2015), *An event-study analysis of ECB balance sheet policies since October 2008*, European Economy Economic Briefs, Directorate-General for Economic and Financial Affairs, European Commission, July.

Chung et al. (2012), "Have We Underestimated the Probability of Hitting the Zero Lower Bound?", *Journal of Money, Credit and Banking*, Vol. 44(2).

Draghi, M. (2018), "Monetary Policy in the Euro Area", speech at The ECB and Its Watchers XIX Conference organized by the Institute for Monetary and Financial Stability, Frankfurt, 14 March.

Draghi, M. (2018), "Monetary Policy in the Euro Area", speech at The ECB Forum on Central Banking, Sintra, 19 June.

Eggertsson et al. (2018), "Monetary policy with negative interest rates", VOX CEPR Policy Portal, 31 January.

Falagiarda and Reitz (2015), "Announcements of ECB unconventional programs: Implications for the sovereign spreads of stressed euro area countries", *Journal of International Money and Finance*, Vol. 53.

FRS, Monetary Policy Report submitted to the Congress on July 7, 2017, pursuant to section 2B of the Federal Reserve Act, Board of Governors of the Federal Reserve System.

Fratzscher et al. (2016), "ECB Unconventional Monetary Policy: Market Impact and International Spillovers", *IMF Economic Review*, Vol. 64(1), International Monetary Fund, Washington, DC.

Gambacorta et al. (2012), "The Effectiveness of Unconventional Monetary Policy at the Zero Lower Bound: A Cross-Country Analysis", *BIS Working Papers* No. 384, Bank of International Settlements, Basel, August.

Gagnon et al. (2011), "The Financial Market Effects of the Federal Reserve's Large-Scale Asset Purchases", *International Journal of Central Banking*, Vol. 7(1).

Gagnon et al. (2015), "Direct and Spillover Effects of Unconventional Monetary and Exchange Rate Policies", Paper presented at the 16th Jacques Polak Annual Research Conference, hosted by the International Monetary Fund, Washington, DC, November.

Gürkaynak et al. (2005), "Do Actions Speak Louder than Words? The Response of Asset Prices to Monetary Policy Actions and Statements", *International Journal of Central Banking*, Vol. 1.

Lenza et al. (2010), "Monetary Policy in Exceptional Times", *Economic Policy*, April, pp. 295-339.

Orphanides (2010), Keynote Speech at the “International Research Forum on Monetary Policy”, Federal Reserve Board, March.

Ugai (2015), “Effects of the Quantitative Easing Policy: A Survey of Empirical Analyses”, *Monetary and Economic Studies*, Vol. 25 (1).

Williams (2014), *Monetary Policy at the Zero Lower Bounds: Putting Theory into Practice*, Hutchins Center on Fiscal & Monetary Policy at Brookings, January. Available at: <http://www.brookings.edu/research/papers/2014/01/16-monetary-policy-zero-lower-bound-williams>

Appendix № 1: Assessment of the econometric models for the euro area Member States, non-euro area EU Member States, US and Japan by the least squares method

Austria

Dependent Variable: AUSTRIA_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 11 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Belgium

Dependent Variable: BELGIUM_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 14 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Germany

Dependent Variable: GERMANY__BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 5 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Variable	Coefficient	Std. Error	t-Statistic	Prob.	Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3,767695	0,245866	15,32418	0	C	4,266774	0,414007	10,30603	0	C	2,861994	0,238495	12,00022	0
EU_EONIA	-0,009095	0,231721	-0,03925	0,9688	EU_EONIA	-0,014169	0,275688	-0,051395	0,9591	EU_EONIA	0,278014	0,215649	1,289195	0,2011
T	-0,042758	0,004688	-9,12019	0	T	-0,046402	0,008045	-5,767407	0	T	-0,033378	0,004543	-7,435481	0
AR(1)	1,223886	0,104174	11,74853	0	AR(1)	1,27009	0,106652	11,90868	0	AR(1)	1,272322	0,103103	12,34028	0
AR(2)	-0,396153	0,104389	-3,79497	0,0003	AR(2)	-0,364457	0,105859	-3,44284	0,0009	AR(2)	-0,429568	0,104403	-4,114507	0,0001
R-squared	0,980735	Mean dependent var	1,933929		R-squared	0,981501	Mean dependent var	2,305		R-squared	0,979231	Mean dependent var	1,452262	
Adjusted R-squared	0,979759	S.D. dependent var	1,114057		Adjusted R-squared	0,980564	S.D. dependent var	1,333593		Adjusted R-squared	0,97818	S.D. dependent var	0,975694	
S.E. of regression	0,158496	Akaike info criterion	-0,76702		S.E. of regression	0,185918	Akaike info criterion	-0,441977		S.E. of regression	0,144127	Akaike info criterion	-0,955008	
Sum squared resid	1,984557	Schw arz criterion	-0,62232		Sum squared resid	2,730686	Schw arz criterion	-0,297286		Sum squared resid	1,641036	Schw arz criterion	-0,810317	
Log likelihood	37,21465	Hannan-Quinn criter.	-0,70885		Log likelihood	23,56304	Hannan-Quinn criter.	-0,383812		Log likelihood	45,11034	Hannan-Quinn criter.	-0,896843	
F-statistic	1005,421	Durbin-Watson stat	2,049324		F-statistic	1047,879	Durbin-Watson stat	1,933694		F-statistic	931,1929	Durbin-Watson stat	2,02054	
Prob(F-statistic)	0				Prob(F-statistic)	0				Prob(F-statistic)	0			

Greece

Dependent Variable: GREECE_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 83
 Convergence achieved after 19 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Ireland

Dependent Variable: IRELAND_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 20 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Spain

Dependent Variable: SPAIN_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 18 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.80043	6.364789	1.696904	0.0938
EJ_EONIA	-1.063556	2.783776	-0.382055	0.7035
T	-0.021213	0.109899	-0.193027	0.8474
AR(1)	1.091599	0.112482	9.704671	0.0000
AR(2)	-0.331318	0.163645	-2.024614	0.0464
AR(3)	0.200566	0.112393	1.784498	0.0783

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.597232	1.850356	3.565385	0.0006
EJ_EONIA	0.392781	0.759539	0.517131	0.6065
T	-0.066003	0.033791	-1.953258	0.0543
AR(1)	1.199474	0.110351	10.86967	0.0000
AR(2)	-0.243495	0.109252	-2.228753	0.0287

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.169412	1.242346	4.161009	0.0001
EJ_EONIA	-0.390713	0.425252	-0.918781	0.3610
T	-0.041507	0.021721	-1.910901	0.0596
AR(1)	1.197975	0.110459	10.84541	0.0000
AR(2)	-0.230302	0.109862	-2.096285	0.0393

R-squared	0.898574	Mean dependent var	11.78940
Adjusted R-squared	0.891987	S.D. dependent var	5.664315
S.E. of regression	1.861592	Akaike info criterion	4.191945
Sum squared resid	266.8455	Schwarz criterion	4.366801
Log likelihood	-167.9657	Hannan-Quinn criter.	4.262192
F-statistic	136.4341	Durbin-Watson stat	1.988414
Prob(F-statistic)	0.000000		

R-squared	0.973644	Mean dependent var	4.226905
Adjusted R-squared	0.972310	S.D. dependent var	3.065617
S.E. of regression	0.510132	Akaike info criterion	1.582576
Sum squared resid	20.55858	Schwarz criterion	1.727268
Log likelihood	-61.46820	Hannan-Quinn criter.	1.640741
F-statistic	729.6054	Durbin-Watson stat	2.015896
Prob(F-statistic)	0.000000		

R-squared	0.973061	Mean dependent var	3.707381
Adjusted R-squared	0.971697	S.D. dependent var	1.700917
S.E. of regression	0.286155	Akaike info criterion	0.429641
Sum squared resid	6.468909	Schwarz criterion	0.574333
Log likelihood	-13.04494	Hannan-Quinn criter.	0.487806
F-statistic	713.3789	Durbin-Watson stat	1.985046
Prob(F-statistic)	0.000000		

Italy

Dependent Variable: ITALY_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 17 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Cyprus

Dependent Variable: CYPRUS_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 12 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Latvia

Dependent Variable: LATVIA_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Failure to improve objective (non-zero gradients) after 58 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.213737	1.097853	4.749029	0.0000
EU_EONIA	-0.456967	0.420287	-1.087275	0.2802
T	-0.040361	0.019945	-2.023580	0.0464
AR(1)	1.238692	0.109129	11.35067	0.0000
AR(2)	-0.278899	0.108183	-2.578035	0.0118

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.125180	1.440039	3.559056	0.0006
EU_EONIA	0.404735	0.456951	0.885729	0.3784
T	-0.009734	0.024261	-0.401231	0.6893
AR(1)	0.977961	0.029085	33.62426	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.871545	0.949570	10.39581	0.0000
EU_EONIA	-0.753347	0.701557	-1.073822	0.2862
T	-0.132704	0.018393	-7.214750	0.0000
AR(1)	1.175715	0.228666	5.141617	0.0000
AR(2)	-0.203924	0.166476	-1.224948	0.2243
AR(11)	-0.132004	0.128282	-1.029018	0.3067

R-squared	0.970246	Mean dependent var	3.623452
Adjusted R-squared	0.968740	S.D. dependent var	1.592844
S.E. of regression	0.281625	Akaike info criterion	0.396247
Sum squared resid	6.265677	Schw arz criterion	0.540938
Log likelihood	-11.64236	Hannan-Quinn criter.	0.454411
F-statistic	644.0295	Durbin-Watson stat	1.997975
Prob(F-statistic)	0.000000		

R-squared	0.943302	Mean dependent var	5.456667
Adjusted R-squared	0.941176	S.D. dependent var	1.249248
S.E. of regression	0.302988	Akaike info criterion	0.533499
Sum squared resid	7.344149	Schw arz criterion	0.649252
Log likelihood	-18.40694	Hannan-Quinn criter.	0.580030
F-statistic	443.6632	Durbin-Watson stat	1.732448
Prob(F-statistic)	0.000000		

R-squared	0.980696	Mean dependent var	4.022262
Adjusted R-squared	0.979459	S.D. dependent var	3.228833
S.E. of regression	0.462763	Akaike info criterion	1.629633
Sum squared resid	16.70368	Schw arz criterion	1.803263
Log likelihood	-62.44459	Hannan-Quinn criter.	1.699431
F-statistic	792.5307	Durbin-Watson stat	1.796435
Prob(F-statistic)	0.000000		

Lithuania

Dependent Variable: LITHUANIA_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 13 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Luxembourg

Dependent Variable: LUXEMBOURG_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 6 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Malta

Dependent Variable: MALTA_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 13 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.878421	0.433061	15.88327	0.0000
EU_EONIA	-0.154843	0.391166	-0.395850	0.6933
T	-0.077393	0.008279	-9.348208	0.0000
AR(1)	1.269108	0.108147	11.73499	0.0000
AR(2)	-0.438345	0.103581	-4.231924	0.0001

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.390923	0.270813	12.52125	0.0000
EU_EONIA	0.167674	0.227524	0.736951	0.4633
T	-0.040185	0.005195	-7.735816	0.0000
AR(1)	1.250882	0.105598	11.84565	0.0000
AR(2)	-0.387294	0.106057	-3.651733	0.0005

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.006613	0.424439	11.79583	0.0000
EU_EONIA	-0.083403	0.175748	-0.474562	0.6364
T	-0.048397	0.007929	-6.103654	0.0000
AR(1)	1.306499	0.106427	12.27600	0.0000
AR(2)	-0.354381	0.105661	-3.353946	0.0012

R-squared	0.978093	Mean dependent var	3.494405
Adjusted R-squared	0.976984	S.D. dependent var	1.799533
S.E. of regression	0.273008	Akaike info criterion	0.322071
Sum squared resid	5.888124	Schwarz criterion	0.466763
Log likelihood	-8.526997	Hannan-Quinn criter.	0.380236
F-statistic	881.7959	Durbin-Watson stat	2.178496
Prob(F-statistic)	0.000000		

R-squared	0.981935	Mean dependent var	1.675357
Adjusted R-squared	0.981021	S.D. dependent var	1.108863
S.E. of regression	0.152764	Akaike info criterion	-0.838340
Sum squared resid	1.843603	Schwarz criterion	-0.693648
Log likelihood	40.21028	Hannan-Quinn criter.	-0.780175
F-statistic	1073.535	Durbin-Watson stat	2.026990
Prob(F-statistic)	0.000000		

R-squared	0.992307	Mean dependent var	3.021429
Adjusted R-squared	0.991917	S.D. dependent var	1.332538
S.E. of regression	0.119800	Akaike info criterion	-1.313364
Sum squared resid	1.133808	Schwarz criterion	-1.168673
Log likelihood	60.16130	Hannan-Quinn criter.	-1.255199
F-statistic	2547.481	Durbin-Watson stat	1.932219
Prob(F-statistic)	0.000000		

Netherlands

Dependent Variable: NETHERLANDS_BONDS

Method: ARMA Generalized Least Squares (Gauss-New ton)

Sample: 2010M01 2016M12

Included observations: 84

Convergence achieved after 4 iterations

Coefficient covariance computed using outer product of gradients

d.f. adjustment for standard errors & covariance

Portugal

Dependent Variable: PORTUGAL_BONDS

Method: ARMA Generalized Least Squares (Gauss-New ton)

Sample: 2010M01 2016M12

Included observations: 84

Convergence achieved after 17 iterations

Coefficient covariance computed using outer product of gradients

d.f. adjustment for standard errors & covariance

Slovakia

Dependent Variable: SLOVAKIA_BONDS

Method: ARMA Generalized Least Squares (Gauss-New ton)

Sample: 2010M01 2016M12

Included observations: 84

Convergence achieved after 13 iterations

Coefficient covariance computed using outer product of gradients

d.f. adjustment for standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.170704	0.227164	13.95779	0.0000
EU_EONIA	0.368140	0.209951	1.753458	0.0834
T	-0.034371	0.004330	-7.937507	0.0000
AR(1)	1.263380	0.102313	12.34821	0.0000
AR(2)	-0.431560	0.103131	-4.184577	0.0001

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.269971	3.386223	1.556298	0.1236
EU_EONIA	0.420766	0.836451	0.503038	0.6163
T	-0.009673	0.052725	-0.183465	0.8549
AR(1)	1.162667	0.111327	10.44374	0.0000
AR(2)	-0.179603	0.111158	-1.615744	0.1101

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.837969	0.698401	6.927208	0.0000
EU_EONIA	-0.135226	0.337273	-0.400941	0.6895
T	-0.048351	0.013367	-3.617112	0.0005
AR(1)	1.257488	0.110144	11.41681	0.0000
AR(2)	-0.316247	0.108997	-2.901442	0.0048

R-squared	0.981142	Mean dependent var	1.759167
Adjusted R-squared	0.980187	S.D. dependent var	1.018856
S.E. of regression	0.143413	Akaike info criterion	-0.965622
Sum squared resid	1.624826	Schw arz criterion	-0.820930
Log likelihood	45.55611	Hannan-Quinn criter.	-0.907457
F-statistic	1027.533	Durbin-Watson stat	2.012135
Prob(F-statistic)	0.000000		

R-squared	0.972170	Mean dependent var	5.975476
Adjusted R-squared	0.970761	S.D. dependent var	3.282188
S.E. of regression	0.561233	Akaike info criterion	1.783450
Sum squared resid	24.88362	Schw arz criterion	1.928142
Log likelihood	-69.90491	Hannan-Quinn criter.	1.841615
F-statistic	689.9232	Durbin-Watson stat	2.089644
Prob(F-statistic)	0.000000		

R-squared	0.980563	Mean dependent var	2.794167
Adjusted R-squared	0.979579	S.D. dependent var	1.579845
S.E. of regression	0.225765	Akaike info criterion	-0.049428
Sum squared resid	4.026610	Schw arz criterion	0.095263
Log likelihood	7.075991	Hannan-Quinn criter.	0.008736
F-statistic	996.3451	Durbin-Watson stat	1.873568
Prob(F-statistic)	0.000000		

Inverted AR Roots .98 .18

Slovenia

Dependent Variable: SLOVENIA_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 14 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Finland

Dependent Variable: FINLAND_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 5 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

France

Dependent Variable: FRANCE_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 10 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.618975	1.394445	4.029542	0.0001
EU_EONIA	-0.628195	0.512847	-1.224917	0.2242
T	-0.048512	0.025838	-1.877570	0.0641
AR(1)	1.331955	0.106855	12.46511	0.0000
AR(2)	-0.372071	0.106302	-3.500132	0.0008

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.180007	0.225064	14.12937	0.0000
EU_EONIA	0.318967	0.215931	1.477170	0.1436
T	-0.034428	0.004266	-8.069578	0.0000
AR(1)	1.222582	0.104033	11.75181	0.0000
AR(2)	-0.400633	0.104878	-3.819970	0.0003

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.671175	0.259865	14.12726	0.0000
EU_EONIA	0.049775	0.228027	0.218284	0.8278
T	-0.038828	0.004996	-7.771239	0.0000
AR(1)	1.297867	0.112765	11.50953	0.0000
AR(2)	-0.577426	0.175481	-3.290536	0.0015
AR(3)	0.129750	0.115803	1.120437	0.2660

R-squared	0.966061	Mean dependent var	3.792500
Adjusted R-squared	0.964342	S.D. dependent var	1.841355
S.E. of regression	0.347708	Akaike info criterion	0.820293
Sum squared resid	9.551159	Schw arz criterion	0.964984
Log likelihood	-29.45230	Hannan-Quinn criter.	0.878457
F-statistic	562.1711	Durbin-Watson stat	2.021489
Prob(F-statistic)	0.000000		

R-squared	0.979700	Mean dependent var	1.756905
Adjusted R-squared	0.978672	S.D. dependent var	1.000496
S.E. of regression	0.146113	Akaike info criterion	-0.929946
Sum squared resid	1.686568	Schw arz criterion	-0.785254
Log likelihood	44.05772	Hannan-Quinn criter.	-0.871781
F-statistic	953.1588	Durbin-Watson stat	1.985139
Prob(F-statistic)	0.000000		

R-squared	0.979015	Mean dependent var	2.022143
Adjusted R-squared	0.977670	S.D. dependent var	1.062460
S.E. of regression	0.158765	Akaike info criterion	-0.751322
Sum squared resid	1.966093	Schw arz criterion	-0.577692
Log likelihood	37.55551	Hannan-Quinn criter.	-0.681524
F-statistic	727.8027	Durbin-Watson stat	1.941173
Prob(F-statistic)	0.000000		

Denmark

Dependent Variable: DENMARK_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 8 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

United Kingdom

Dependent Variable: UNITEDKINGDOM_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 9 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Poland

Dependent Variable: POLAND_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 5 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Variable	Coefficient	Std. Error	t-Statistic	Prob.	Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.036596	0.302750	10.03006	0.0000	C	3.247986	0.376381	8.629525	0.0000	C	6.123569	0.447961	13.66988	0.0000
EU_EONIA	0.194972	0.262591	0.742494	0.4600	EU_EONIA	0.157333	0.254234	0.618849	0.5378	EU_EONIA	0.049052	0.279548	0.175470	0.8612
T	-0.033975	0.005770	-5.888257	0.0000	T	-0.025173	0.007281	-3.457350	0.0009	T	-0.041581	0.008978	-4.631185	0.0000
AR(1)	1.211032	0.106993	11.31883	0.0000	AR(1)	1.354713	0.102349	13.23622	0.0000	AR(1)	1.305130	0.104794	12.45423	0.0000
AR(2)	-0.354148	0.106633	-3.321179	0.0014	AR(2)	-0.457236	0.101043	-4.525151	0.0000	AR(2)	-0.393096	0.107721	-3.649220	0.0005
R-squared	0.968869	Mean dependent var	1.592143		R-squared	0.954403	Mean dependent var	2.159881		R-squared	0.979075	Mean dependent var	4.289167	
Adjusted R-squared	0.967293	S.D. dependent var	0.964245		Adjusted R-squared	0.952095	S.D. dependent var	0.795356		Adjusted R-squared	0.978016	S.D. dependent var	1.282626	
S.E. of regression	0.174385	Akaike info criterion	-0.575086		S.E. of regression	0.174082	Akaike info criterion	-0.571544		S.E. of regression	0.190176	Akaike info criterion	-0.395042	
Sum squared resid	2.402399	Schwarz criterion	-0.430394		Sum squared resid	2.394062	Schwarz criterion	-0.426853		Sum squared resid	2.857190	Schwarz criterion	-0.250350	
Log likelihood	29.15361	Hannan-Quinn criter.	-0.516921		Log likelihood	29.00485	Hannan-Quinn criter.	-0.513379		Log likelihood	21.59175	Hannan-Quinn criter.	-0.336877	
F-statistic	614.6675	Durbin-Watson stat	1.985624		F-statistic	413.3949	Durbin-Watson stat	1.997748		F-statistic	924.1060	Durbin-Watson stat	1.962321	
Prob(F-statistic)	0.000000				Prob(F-statistic)	0.000000				Prob(F-statistic)	0.000000			

Romania

Dependent Variable: ROMANIA_BONDS

Method: ARMA Generalized Least Squares (Gauss-New ton)

Sample: 2010M01 2016M12

Included observations: 84

Convergence achieved after 11 iterations

Coefficient covariance computed using outer product of gradients

d.f. adjustment for standard errors & covariance

Hungary

Dependent Variable: HUNGARY_BONDS

Method: ARMA Generalized Least Squares (Gauss-New ton)

Sample: 2010M01 2016M12

Included observations: 84

Convergence achieved after 15 iterations

Coefficient covariance computed using outer product of gradients

d.f. adjustment for standard errors & covariance

Croatia

Dependent Variable: CROATIA_BONDS

Method: ARMA Generalized Least Squares (Gauss-New ton)

Sample: 2010M01 2016M12

Included observations: 84

Convergence achieved after 14 iterations

Coefficient covariance computed using outer product of gradients

d.f. adjustment for standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.398432	0.422345	19.88526	0.0000
EU_EONIA	-0.119665	0.383730	-0.311847	0.7560
T	-0.067108	0.008111	-8.274133	0.0000
AR(1)	1.181392	0.110215	10.71902	0.0000
AR(2)	-0.344058	0.110606	-3.110651	0.0026

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.663883	0.948475	9.134538	0.0000
EU_EONIA	-0.872861	0.507380	-1.720329	0.0892
T	-0.068021	0.017442	-3.899808	0.0002
AR(1)	0.941326	0.039778	23.66474	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.685129	0.531525	12.57726	0.0000
EU_EONIA	0.192076	0.381282	0.503763	0.6158
T	-0.042687	0.010200	-4.184951	0.0001
AR(1)	1.167629	0.110585	10.55866	0.0000
AR(2)	-0.269587	0.109158	-2.469699	0.0157

R-squared	0.975566	Mean dependent var	5.430595
Adjusted R-squared	0.974328	S.D. dependent var	1.651617
S.E. of regression	0.264628	Akaike info criterion	0.257330
Sum squared resid	5.532231	Schwarz criterion	0.402022
Log likelihood	-5.807861	Hannan-Quinn criter.	0.315495
F-statistic	788.5335	Durbin-Watson stat	2.198622
Prob(F-statistic)	0.000000		

R-squared	0.969652	Mean dependent var	5.730833
Adjusted R-squared	0.968514	S.D. dependent var	1.925606
S.E. of regression	0.341684	Akaike info criterion	0.762449
Sum squared resid	9.339838	Schwarz criterion	0.878202
Log likelihood	-28.02286	Hannan-Quinn criter.	0.808981
F-statistic	852.0370	Durbin-Watson stat	1.781281
Prob(F-statistic)	0.000000		

R-squared	0.966101	Mean dependent var	4.960238
Adjusted R-squared	0.964385	S.D. dependent var	1.348881
S.E. of regression	0.254560	Akaike info criterion	0.183175
Sum squared resid	5.119273	Schwarz criterion	0.327867
Log likelihood	-2.693368	Hannan-Quinn criter.	0.241340
F-statistic	562.8683	Durbin-Watson stat	2.030212
Prob(F-statistic)	0.000000		

Sweden

Dependent Variable: SWEDEN_BONDS

Method: ARMA Generalized Least Squares (Gauss-New ton)

Sample: 2010M01 2016M12

Included observations: 84

Convergence achieved after 4 iterations

Coefficient covariance computed using outer product of gradients

d.f. adjustment for standard errors & covariance

Bulgaria

Dependent Variable: BULGARIA_BONDS

Method: ARMA Generalized Least Squares (Gauss-New ton)

Sample: 2010M01 2016M12

Included observations: 84

Convergence achieved after 8 iterations

Coefficient covariance computed using outer product of gradients

d.f. adjustment for standard errors & covariance

Czech Republic

Dependent Variable: CZECHREPUBLIC_BONDS

Method: ARMA Generalized Least Squares (Gauss-New ton)

Sample: 2010M01 2016M12

Included observations: 84

Convergence achieved after 7 iterations

Coefficient covariance computed using outer product of gradients

d.f. adjustment for standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.046721	0.333442	9.137194	0.0000
EU_EONIA	0.140387	0.246326	0.569925	0.5703
T	-0.030479	0.006434	-4.736840	0.0000
AR(1)	1.302354	0.103962	12.52721	0.0000
AR(2)	-0.413376	0.104273	-3.964346	0.0002

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.388083	0.258881	20.81300	0.0000
BULGARIA_IR	3.709416	0.808293	4.589198	0.0000
T	-0.041934	0.004435	-9.454457	0.0000
AR(1)	0.806398	0.067933	11.87049	0.0000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.237365	0.246216	17.20997	0.0000
EU_EONIA	0.194921	0.251564	0.774834	0.4408
T	-0.049697	0.004656	-10.67384	0.0000
AR(1)	1.207703	0.102476	11.78519	0.0000
AR(2)	-0.424593	0.104513	-4.062574	0.0001

R-squared	0.968521	Mean dependent var	1.740952
Adjusted R-squared	0.966927	S.D. dependent var	0.906307
S.E. of regression	0.164821	Akaike info criterion	-0.683267
Sum squared resid	2.146101	Schw arz criterion	-0.538575
Log likelihood	33.69720	Hannan-Quinn criter.	-0.625102
F-statistic	607.6513	Durbin-Watson stat	1.988091
Prob(F-statistic)	0.000000		

R-squared	0.985160	Mean dependent var	3.920476
Adjusted R-squared	0.984604	S.D. dependent var	1.365434
S.E. of regression	0.169424	Akaike info criterion	-0.653869
Sum squared resid	2.296361	Schw arz criterion	-0.538115
Log likelihood	31.46248	Hannan-Quinn criter.	-0.607337
F-statistic	1770.333	Durbin-Watson stat	1.930811
Prob(F-statistic)	0.000000		

R-squared	0.983109	Mean dependent var	2.151905
Adjusted R-squared	0.982253	S.D. dependent var	1.348561
S.E. of regression	0.179651	Akaike info criterion	-0.518093
Sum squared resid	2.549680	Schw arz criterion	-0.373401
Log likelihood	26.75989	Hannan-Quinn criter.	-0.459928
F-statistic	1149.483	Durbin-Watson stat	1.779348
Prob(F-statistic)	0.000000		

USA

Dependent Variable: UNITED_STATES_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 10 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Japan

Dependent Variable: JAPAN_BONDS
 Method: ARMA Generalized Least Squares (Gauss-New ton)
 Sample: 2010M01 2016M12
 Included observations: 84
 Convergence achieved after 16 iterations
 Coefficient covariance computed using outer product of gradients
 d.f. adjustment for standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.984800	0.391658	7.620942	0.0000
UNITED_STATES_IR	0.487759	0.528706	0.922553	0.3590
T	-0.015584	0.007815	-1.994149	0.0496
AR(1)	1.235662	0.112727	10.96152	0.0000
AR(2)	-0.324873	0.111450	-2.914957	0.0046

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.266037	0.043307	29.23395	0.0000
JAPAN_IR	0.710946	0.238965	2.975100	0.0039
T	-0.014950	0.000672	-22.24634	0.0000
AR(1)	0.684974	0.080321	8.527942	0.0000
AR(6)	-0.227966	0.082559	-2.761261	0.0072

R-squared	0.909819	Mean dependent var	2.370119
Adjusted R-squared	0.905253	S.D. dependent var	0.597774
S.E. of regression	0.184001	Akaike info criterion	-0.463141
Sum squared resid	2.674653	Schwarz criterion	-0.318450
Log likelihood	24.45192	Hannan-Quinn criter.	-0.404976
F-statistic	199.2539	Durbin-Watson stat	2.048004
Prob(F-statistic)	0.000000		

R-squared	0.977893	Mean dependent var	0.679167
Adjusted R-squared	0.976774	S.D. dependent var	0.416871
S.E. of regression	0.063531	Akaike info criterion	-2.601929
Sum squared resid	0.318862	Schwarz criterion	-2.457237
Log likelihood	114.2810	Hannan-Quinn criter.	-2.543764
F-statistic	873.6477	Durbin-Watson stat	1.708672
Prob(F-statistic)	0.000000		

Appendix № 2: Autocorrelations and autocorrelograms of the residual component ε_t by countries

Austria							Belgium							Germany						
Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms							Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms							Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...		Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...		Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...	
		1 -0.02...	-0.02...	0.0533					1 0.027	0.027	0.0653					1 -0.01...	-0.01...	0.0257		
		2 -0.02...	-0.02...	0.1218					2 -0.13...	-0.13...	1.5838					2 -0.10...	-0.10...	1.0315		
		3 0.137	0.136	1.8016	0.180				3 0.051	0.059	1.8123	0.178				3 0.183	0.181	4.0243	0.045	
		4 -0.02...	-0.02...	1.8572	0.395				4 0.029	0.008	1.8865	0.389				4 0.012	0.004	4.0379	0.133	
		5 -0.04...	-0.04...	2.0589	0.560				5 0.111	0.127	3.0127	0.390				5 -0.09...	-0.06...	4.9214	0.178	
		6 -0.00...	-0.02...	2.0591	0.725				6 -0.00...	-0.01...	3.0134	0.556				6 -0.01...	-0.05...	4.9552	0.292	
		7 -0.02...	-0.02...	2.1087	0.834				7 0.099	0.135	3.9389	0.558				7 -0.06...	-0.08...	5.3168	0.378	
		8 -0.21...	-0.20...	6.3491	0.385				8 -0.12...	-0.16...	5.4529	0.487				8 0.004	0.027	5.3187	0.504	
		9 -0.02...	-0.03...	6.3985	0.494				9 -0.13...	-0.09...	7.1247	0.416				9 -0.19...	-0.20...	9.0647	0.248	
		1... -0.03...	-0.04...	6.5201	0.589				1... 0.099	0.040	8.0866	0.425				1... 0.058	0.090	9.3913	0.310	
									1... -0.01...	-0.03...	8.0992	0.524				1... 0.092	0.044	10.228	0.332	
									1... -0.10...	-0.09...	9.1759	0.515				1... 0.077	0.167	10.821	0.372	

Italy							Latvia							Lithuania						
Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms							Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 3 ARMA terms							Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...		Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...		Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...	
		1 -0.00...	-0.00...	0.0059					1 0.094	0.094	0.7649					1 -0.12...	-0.12...	1.3276		
		2 0.022	0.022	0.0484					2 0.011	0.002	0.7751					2 -0.18...	-0.20...	4.3352		
		3 -0.14...	-0.14...	1.8099	0.179				3 0.035	0.035	0.8875					3 0.152	0.105	6.3987		
		4 0.011	0.009	1.8212	0.402				4 -0.05...	-0.05...	1.1314	0.287				4 0.035	0.035	6.5081		
		5 -0.06...	-0.05...	2.1524	0.541				5 0.036	0.047	1.2508	0.535				5 0.096	0.164	7.3594		
		6 0.046	0.026	2.3494	0.672				6 0.012	0.004	1.2651	0.737				6 0.016	0.051	7.3842		
		7 0.222	0.232	6.9662	0.223				7 0.060	0.064	1.6070	0.808				7 -0.00...	0.040	7.3911		
		8 -0.01...	-0.03...	6.9990	0.321				8 -0.08...	-0.11...	2.3627	0.797				8 0.101	0.085	8.3593		
		9 0.069	0.077	7.4522	0.383				9 0.088	0.116	3.1056	0.795				9 -0.02...	-0.02...	8.4403		
		1... 0.082	0.153	8.1012	0.424				1... 0.252	0.234	9.3284	0.230				1... -0.02...	-0.02...	8.4856		
		1... 0.006	-0.01...	8.1052	0.524				1... -0.16...	-0.22...	12.044	0.149				1... -0.01...	-0.07...	8.5014		
		1... -0.05...	-0.01...	8.4559	0.584				1... 0.031	0.052	12.142	0.205				1... -0.04...	-0.08...	8.7432		

*Probabilities may not be valid for this equation specification.

Luxembourg

Sample: 2010M01 2016M12
 Included observations: 84
 Q-statistic probabilities adjusted for 2 ARMA terms

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...
		1 -0.02... -0.02...	0.0422		
		2 -0.03... -0.03...	0.1625		
		3 0.056 0.055	0.4437	0.505	
		4 0.072 0.074	0.9155	0.633	
		5 -0.00... 0.002	0.9184	0.821	
		6 -0.10... -0.10...	1.8799	0.758	
		7 -0.02... -0.03...	1.9207	0.860	
		8 0.049 0.038	2.1533	0.905	
		9 -0.19... -0.18...	5.7664	0.567	
		1... 0.023 0.036	5.8176	0.668	
		1... 0.097 0.092	6.7561	0.662	
		1... -0.04... -0.03...	6.9175	0.733	

Malta

Sample: 2010M01 2016M12
 Included observations: 84
 Q-statistic probabilities adjusted for 2 ARMA terms

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...
		1 0.023 0.023	0.0449		
		2 -0.12... -0.12...	1.4199		
		3 0.074 0.081	1.9049	0.168	
		4 -0.04... -0.06...	2.0476	0.359	
		5 -0.07... -0.05...	2.5461	0.467	
		6 0.158 0.148	4.8716	0.301	
		7 -0.01... -0.03...	4.8925	0.429	
		8 -0.04... -0.00...	5.1109	0.530	
		9 -0.07... -0.11...	5.6333	0.583	
		1... -0.16... -0.16...	8.2646	0.408	
		1... 0.122 0.148	9.7344	0.372	
		1... 0.212 0.160	14.259	0.161	

Netherlands

Sample: 2010M01 2016M12
 Included observations: 84
 Q-statistic probabilities adjusted for 2 ARMA terms

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...
		1 -0.00... -0.00...	0.0067		
		2 -0.08... -0.08...	0.5953		
		3 0.103 0.102	1.5336	0.216	
		4 0.065 0.061	1.9164	0.384	
		5 -0.05... -0.03...	2.1843	0.535	
		6 -0.06... -0.06...	2.5138	0.642	
		7 -0.00... -0.02...	2.5154	0.774	
		8 -0.06... -0.06...	2.8569	0.827	
		9 -0.22... -0.21...	7.5926	0.370	
		1... 0.052 0.048	7.8594	0.447	
		1... 0.046 0.027	8.0731	0.527	
		1... 0.063 0.126	8.4723	0.583	

Slovakia

Sample: 2010M01 2016M12
 Included observations: 84
 Q-statistic probabilities adjusted for 2 ARMA terms

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...
		1 0.064 0.064	0.3528		
		2 -0.12... -0.13...	1.7929		
		3 -0.14... -0.13...	3.7044	0.054	
		4 0.045 0.048	3.8889	0.143	
		5 0.082 0.044	4.5025	0.212	
		6 0.069 0.055	4.9409	0.293	
		7 0.072 0.097	5.4303	0.366	
		8 0.085 0.110	6.1091	0.411	
		9 -0.04... -0.02...	6.2867	0.507	
		1... 0.088 0.135	7.0357	0.533	
		1... 0.013 0.005	7.0516	0.632	
		1... -0.12... -0.14...	8.4870	0.581	

Finland

Sample: 2010M01 2016M12
 Included observations: 84
 Q-statistic probabilities adjusted for 2 ARMA terms

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...
		1 0.004 0.004	0.0012		
		2 -0.11... -0.11...	1.1568		
		3 0.146 0.149	3.0609	0.080	
		4 0.040 0.024	3.2062	0.201	
		5 -0.08... -0.05...	3.8823	0.274	
		6 -0.01... -0.02...	3.9073	0.419	
		7 -0.03... -0.06...	4.0516	0.542	
		8 0.000 0.017	4.0516	0.670	
		9 -0.17... -0.17...	6.8374	0.446	
		1... -0.00... 0.018	6.8380	0.554	
		1... 0.073 0.035	7.3642	0.599	
		1... 0.070 0.118	7.8526	0.643	

France

Sample: 2010M01 2016M12
 Included observations: 84
 Q-statistic probabilities adjusted for 3 ARMA terms

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...
		1 0.028 0.028	0.0707		
		2 -0.09... -0.09...	0.9199		
		3 0.180 0.188	3.8254		
		4 -0.01... -0.03...	3.8362	0.050	
		5 -0.00... 0.039	3.8371	0.147	
		6 -0.09... -0.14...	4.6485	0.199	
		7 0.032 0.063	4.7420	0.315	
		8 -0.12... -0.17...	6.2380	0.284	
		9 -0.12... -0.04...	7.7122	0.260	
		1... -0.00... -0.06...	7.7122	0.359	
		1... 0.032 0.094	7.8116	0.452	
		1... 0.007 -0.00...	7.8170	0.553	

Denmark							United Kingdom							Poland							
Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms							Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms							Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms							
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...		Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...		Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...		
		1 -0.00...	-0.00...	0.0012					1 -0.01...	-0.01...	0.0164					1 0.018	0.018	0.0285			
		2 -0.10...	-0.10...	0.9566					2 -0.08...	-0.08...	0.6127					2 -0.05...	-0.05...	0.2894			
		3 0.111	0.111	2.0535	0.152				3 0.132	0.131	2.1738	0.140				3 0.023	0.025	0.3373	0.561		
		4 -0.01...	-0.02...	2.0634	0.356				4 -0.15...	-0.16...	4.2870	0.117				4 -0.07...	-0.07...	0.7770	0.678		
		5 0.027	0.051	2.1286	0.546				5 0.007	0.033	4.2921	0.232				5 0.149	0.156	2.8139	0.421		
		6 -0.05...	-0.07...	2.4259	0.658				6 0.016	-0.03...	4.3169	0.365				6 0.147	0.134	4.8037	0.308		
		7 0.038	0.054	2.5637	0.767				7 -0.01...	0.030	4.3448	0.501				7 -0.05...	-0.03...	5.0461	0.410		
		8 -0.00...	-0.03...	2.5689	0.861				8 -0.09...	-0.13...	5.1693	0.522				8 -0.14...	-0.15...	7.1205	0.310		
		9 -0.22...	-0.20...	7.4906	0.380				9 -0.01...	-0.00...	5.1939	0.636				9 0.038	0.055	7.2584	0.402		
		1...	0.007	-0.00...	7.4949	0.484			1...	0.125	0.106	6.7245	0.567				1...	0.000	-0.01...	7.2584	0.509
		1...	0.110	0.081	8.6996	0.465			1...	0.063	0.094	7.1152	0.625				1...	-0.03...	-0.07...	7.4033	0.595
		1...	0.061	0.109	9.0677	0.526			1...	0.068	0.059	7.5854	0.669				1...	-0.01...	-0.05...	7.4313	0.684

Romania							Hungary							Croatia							
Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms							Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 1 ARMA term							Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms							
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...		Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...		Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...		
		1 -0.09...	-0.09...	0.8475					1 0.105	0.105	0.9571					1 -0.02...	-0.02...	0.0537			
		2 -0.00...	-0.01...	0.8527					2 -0.07...	-0.08...	1.4540	0.228				2 -0.03...	-0.04...	0.1880			
		3 0.039	0.037	0.9885	0.320				3 0.035	0.053	1.5609	0.458				3 0.159	0.157	2.4351	0.119		
		4 0.155	0.164	3.1486	0.207				4 -0.10...	-0.12...	2.6147	0.455				4 -0.00...	-0.00...	2.4386	0.295		
		5 -0.15...	-0.13...	5.4488	0.142				5 0.227	0.272	7.3082	0.120				5 0.031	0.044	2.5268	0.470		
		6 0.083	0.059	6.0805	0.193				6 0.187	0.104	10.540	0.061				6 -0.01...	-0.03...	2.5435	0.637		
		7 0.055	0.053	6.3603	0.273				7 -0.03...	-0.01...	10.673	0.099				7 0.006	0.009	2.5464	0.769		
		8 0.022	0.023	6.4067	0.379				8 -0.08...	-0.10...	11.371	0.123				8 -0.00...	-0.02...	2.5520	0.863		
		9 -0.11...	-0.08...	7.7370	0.356				9 -0.03...	0.028	11.498	0.175				9 -0.12...	-0.11...	3.9663	0.784		
		1...	0.151	0.096	9.9563	0.268			1...	-0.08...	-0.13...	12.250	0.200				1...	-0.19...	-0.21...	7.8054	0.453
		1...	-0.07...	-0.06...	10.550	0.308			1...	-0.10...	-0.17...	13.415	0.201				1...	0.073	0.062	8.3360	0.501
		1...	-0.06...	-0.06...	10.911	0.364			1...	0.057	0.048	13.742	0.248				1...	-0.09...	-0.07...	9.1668	0.516

Czech Republic							Bulgaria							Sweden						
Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms							Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 1 ARMA term							Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...		Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...	Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...		
█	█	1 0.110	0.110	1.0523			█	█	1 0.033	0.033	0.0937		█	█	1 -0.00...	-0.00...	2.E-05			
█	█	2 -0.22...	-0.24...	5.5241			█	█	2 0.037	0.036	0.2158	0.642	█	█	2 -0.11...	-0.11...	1.0835			
█	█	3 -0.01...	0.043	5.5512	0.018		█	█	3 0.150	0.148	2.2278	0.328	█	█	3 0.176	0.178	3.8357	0.050		
█	█	4 0.197	0.150	9.0651	0.011		█	█	4 0.054	0.045	2.4886	0.477	█	█	4 0.010	-0.00...	3.8454	0.146		
█	█	5 0.061	0.020	9.4095	0.024		█	█	5 -0.18...	-0.20...	5.5878	0.232	█	█	5 -0.06...	-0.02...	4.1868	0.242		
█	█	6 0.017	0.090	9.4374	0.051		█	█	6 -0.03...	-0.05...	5.7317	0.333	█	█	6 0.061	0.033	4.5317	0.339		
█	█	7 0.002	0.004	9.4378	0.093		█	█	7 -0.10...	-0.10...	6.7128	0.348	█	█	7 -0.06...	-0.08...	4.9522	0.422		
█	█	8 -0.17...	-0.20...	12.380	0.054		█	█	8 -0.12...	-0.06...	8.2343	0.312	█	█	8 -0.01...	0.014	4.9737	0.547		
█	█	9 -0.06...	-0.03...	12.789	0.077		█	█	9 -0.14...	-0.10...	10.214	0.250	█	█	9 -0.11...	-0.15...	6.2515	0.511		
█	█	1... 0.030	-0.06...	12.877	0.116		█	█	1... 0.134	0.160	11.973	0.215	█	█	1... -0.00...	0.030	6.2517	0.619		
█	█	1... 0.012	-0.01...	12.890	0.168		█	█	1... -0.27...	-0.27...	19.406	0.035	█	█	1... 0.041	0.017	6.4178	0.697		
█	█	1... -0.15...	-0.09...	15.272	0.122		█	█	1... 0.019	0.044	19.441	0.054	█	█	1... 0.145	0.197	8.5266	0.578		

USA							Japan						
Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms							Sample: 2010M01 2016M12 Included observations: 84 Q-statistic probabilities adjusted for 2 ARMA terms						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...		Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob...	
█	█	1 -0.03...	-0.03...	0.1269			█	█	1 0.141	0.141	1.7313		
█	█	2 0.002	0.001	0.1275			█	█	2 -0.10...	-0.13...	2.7621		
█	█	3 0.133	0.134	1.7095	0.191		█	█	3 0.021	0.059	2.8010	0.094	
█	█	4 -0.15...	-0.14...	3.8755	0.144		█	█	4 -0.10...	-0.13...	3.7468	0.154	
█	█	5 0.069	0.061	4.3063	0.230		█	█	5 -0.16...	-0.12...	6.2391	0.101	
█	█	6 0.014	0.000	4.3239	0.364		█	█	6 -0.11...	-0.10...	7.3595	0.118	
█	█	7 -0.20...	-0.17...	8.1452	0.148		█	█	7 0.107	0.119	8.4353	0.134	
█	█	8 -0.03...	-0.08...	8.2358	0.221		█	█	8 0.012	-0.05...	8.4501	0.207	
█	█	9 -0.07...	-0.06...	8.8027	0.267		█	█	9 -0.04...	-0.03...	8.6175	0.281	
█	█	1... 0.180	0.238	11.961	0.153		█	█	1... 0.032	-0.01...	8.7152	0.367	
█	█	1... 0.006	-0.02...	11.965	0.215		█	█	1... 0.037	0.026	8.8539	0.451	
█	█	1... 0.058	0.091	12.305	0.265		█	█	1... -0.18...	-0.19...	12.392	0.260	

Physical Internet, Industry 4.0 and Logistics 4.0 in Responsible Development Plan of Polish Economy

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Abstract: Digitalization of economies is one of the most recognized directions of development of contemporary economies. Digitalization of economies in area of industry could be represented by conceptions such as: Physical Internet, Industry 4.0 and Logistics 4.0. 'Responsible Development Plan' (RDP) is a conception of development of Polish economy to 2020 (with perspective to 2030). Main aim of this paper is identification of features of: Physical Internet, Industry 4.0, Logistics 4.0 in RDP. In paper, systematic literature review of: 'Physical Internet', 'Industry 4.0', 'Logistics 4.0' and 'Responsible Development Plan' was used. Authors have developed a thesis that better developed countries (measured by GDP) are more interested into introducing industry 4.0 conception. For verifying a hypothesis correlation index was used. Authors show that there is a correlation between number of scientific papers (about analyzed conceptions) and GDP of the country in which these publications are developed. It shows that Physical Internet, Industry 4.0 and Logistics 4.0 conceptions are developed in more developed countries. There is a lot of references to Physical Internet, Industry 4.0 and Logistics 4.0 (mainly to Industry 4.0) in RDP. It shows that RDP includes right analysis of current state and draws from experiences of more developed countries.

Keywords: Responsible Development Plan, Physical Internet, Industry 4.0, Logistics 4.0, Digitalization of economy

1 Introduction

The economic development is one of the elements of the increase in societies' living standards and is also one of the sustainable development pillars. Therefore, it is significant to give an answer to the question about how to develop world economies to maintain their stable growth. One of the solutions is to digitise economies. The leading concepts within digitising economies in industry and logistics are: Physical Internet, Industry 4.0 and Logistics 4.0. In the first part of this publication, the authors formulated a hypothesis that the better developed countries (with higher GDP values) are characterised by a higher interest in the economy digitisation concepts. In order to verify the above hypothesis, the authors analysed a number of scientific publications on the concepts of Physical Internet, Industry 4.0 and Logistics 4.0 as developed by authors or (teams of authors) from certain countries and compared their results with the GDP values of the countries. In the second part, the authors performed a detailed

analysis of the Responsible Development Plan strategy, which is a leading Polish economy development strategy. This analysis was oriented to identifying the Polish economy digitisation assumptions.

2 Theoretical background

The Physical Internet (PI) is a term that was first mentioned in 2006 by Benoit Montreuil from Université Laval in Canada. As regards to the article entitled "The Physical Internet. A survey of logistics" published in "The Economist", it includes the first presentation of the Physical Internet assumptions on a dozen or so pages (Montreuil 2006). The Physical Internet aims at ensuring the stability, global mobility of a physical object and the ability to collect, store, sell and use it (www.modulushca.eu). This is predominantly the ability to provide the most efficient method to relocate the goods to a given place in a short period of time.

The Physical Internet is organised similarly to data packages sent within the traditionally perceived digital Internet. This concept radically transforms the present idea of goods design, relocation and distribution. It is absolutely essential for all supply chain participants (Montreuil et al. 2012) to have the above method in which the goods relocation process is known and performed at each relocation stage in an optimal and efficient way. Beforehand, the process was ensured to be open, efficient and environmentally friendly (Domański et al. 2017).

The term Industry 4.0 was introduced at a trade fair in 2011 in Germany (Szozda 2017). This term is known as the 4th Industrial Revolution and is referred to new networking-based trends. Industry 4.0 predominately regards production areas related to other technological concepts, such as M2M communication, RFID technology, CPD, IoT and Cloud Computing (Wang 2016). The term Industry 4.0 includes the development and implementation of competitive products as well as elastic administrative, production and logistic systems (Rennung et al. 2016). Industry 4.0 is also perceived as CPS (Cyber-Physical Systems) integration in factories, warehousing systems and logistics (Wang et al. 2016) by means of the Internet of Things applications in industrial processes Prause and Weigand 2016). As part of Industry 4.0 one also uses solutions and tools that influence innovations in which is considered to be a domain of the 4th Industrial Revolution (Szymańska et al. 2017).

Logistics 4.0 is a narrower term than Industry 4.0 in spite of having similar assumptions. Jeschke (Jeschke 2016) defines the term Logistics 4.0 from two approaches. As regards to the short-term approach Logistics 4.0 is defined as firm and mutually related processes between independent members with the use of large amounts of data. As to the medium-term approach Logistics 4.0 is defined as autonomous, self-organising systems within other systems. Similar definitions are made by Timm and Lorig (2015). In their view Logistics 4.0 is logistic systems which consist of independent subsystems. The behavior of the subsystems depends on other surrounding subsystems. This term also means process automatization and co-organisation and the Industry 4.0 support (Hompele and Kerner 2015). The Logistics 4.0 definition combines two aspects: processual (supply chain processes are a subject of the

Logistics 4.0 actions) and technical (tools and technologies that support internal processes in the supply chains) (Szymańska et al. 2017).

Due to the similarities between the Logistics 4.0 and Industry 4.0 concepts, the former one is based on its typical features, i.a. digitalisation, automatisisation, net-working and mobility (Pfohl et al. 2015). The Logistics 4.0 technological solutions are based on using drones, self-steering vehicles, sensors, Big Data, GPS, RFID, M2M. As part of the concept, the technologies dedicated to modern enterprises use i.a. virtual reality glasses, intelligent transporters, gates, forklifts and automatic vehicles (DHL 2015).

3 Systematic literature review

3.1 Methodology

The literature query was performed on 24 March 2018. The analysis subject was the Scopus database of scientific journals. The question was formulated in such a way that the catchwords "Physical Internet", "Industry 4.0" and "Logistics 4.0" were searched for in the title, summary and key words (the search was separately performed in the case of each catchword).

Remarks about analysing and interpreting the database of results:

1. „Physical Internet”

- altogether 106 articles were identified,
- the articles are authored by representatives of 31 countries, the further analysis is conducted for countries with at least 2 articles,
- the scope of the article subjects includes 7 scientific domains, the further analysis is conducted for domains represented by at least 2 articles.

2. „Industry 4.0”,

- altogether 2168 articles were identified,
- the articles are authored by representatives of 67 countries, the further analysis is conducted for countries with at least 20 articles,
- the scope of the article subjects includes 24 scientific domains, the further analysis is conducted for domains represented by at least 20 articles.

3. „Logistics 4.0”

- altogether 10 articles were identified,
- the articles are authored by representatives of 8 countries, the further analysis is conducted for all the countries,
- the scope of the article subjects includes 8 scientific domains, the further analysis is conducted for all the domains.

Detailed analysis of literature is presented in two following subchapters.

3.2 Quantitative analysis of publications from all countries

From the historic point of view, the oldest scientifically discussed concept is the Physical Internet. It already appeared in 2004 and has been present in science for 14 years now. Over the years the Physical Internet concept has been of interest to researchers to a various degree. Since 2011 there has been an annual coherent increase in the interest in the Physical Internet concept. The remaining concepts belong to a slightly younger generation. Industry 4.0 appeared in 2012 (has existed in science for 6 years), Logistics 4.0 has been present since 2015 (3 years in science). One might hypothesise at this point that the Physical Internet concept caused an Industry 4.0 stream to be established (as one of detailed Physical Internet strands), whereas the Industry 4.0 concept naturally implied the necessity to establish the Logistics 4.0 stream (as one of the detailed Industry 4.0 strands). This is similar to the classical relationship – it is required by the traditional manufacturing fulfillment to be protected by logistics – the same relationship should exist in Industry 4.0 conditions: it is required by Industry 4.0 to make Logistics 4.0 exist and function. While analysing the time span from 2011 to 2018, the interdependence of all 3 concepts becomes apparent. The above time span confirms their historic evolution at the same time. Number of papers in each year are presented in table 1.

Table 1: Number of publications

	Physical Internet	Industry 4.0	Logistics 4.0
2004	1		
2005	1		
2006	2		
2007	4		1
2008	3		
2009	0		
2010	1		
2011	5		
2012	6	2	
2013	6	33	
2014	8	94	
2015	19	225	1
2016	23	553	3
2017	21	1070	3
2018	6	191	2
Total	106	2168	10

Industry 4.0 is the most frequently discussed concept (2168 articles) due to the number of publications. Industry 4.0 has an apparent and dominating advantage over the remaining two ones. The number of articles on the Physical Internet is 106 and works on Logistics 4.0. is scarcely 10. The present situation might be explained by the fact that the articles on Industry 4.0 are placed within the Physical Internet stream. However, the authors prefer to index their works by a newer and more specific (narrower) term. This is caused by the appearance of Industry 4.0 as a new term. But the number of Logistics 4.0-related works should not be a surprise. This is a young concept at the early development stage. What will be shown by the time prospect is whether this stream should be formally regarded as a separate one. This is similar to the way the Physical Internet was acknowledged (in the case of Industry 4.0 the

mechanism is reverse). Perhaps some authors are not sufficiently courageous to label their works related to Logistics 4.0 since they belong to the Industry 4.0 stream.

The Industry 4.0 concept is an apparent leader in terms of the dynamics of the increase in publications. Between 2012 and 2018 one could notice a 2- or 3-time time annual increase in the number of articles that belong to the Industry 4.0 category. A growing dynamics is also shown by the Physical Internet concept. Nevertheless, the pace of increasing the publication number is definitely smaller. As to the Logistics 4.0 concept, its assessment is quite difficult as there is no sufficiently broad database. As of now, the number of publications might be stated to get stabilised at a constant repeatable level. The publication dynamics is undoubtedly strongly related to the number of publications. This is an attempt to explain the present state of the analysed publications. It is difficult to expect that the concept represented by a large set of articles would not be a developmental concept (increase in the article dynamics) at the same time. Apart from that, the dynamics in the increase in the publication number is partly explained by the functioning of the same mechanisms. The mechanisms were described in the context of the publication number. In this connection, such an explanation will not be repeated at this point.

If one considers the national appurtenance of centres represented by particular works (authors), one should state that Industry 4.0 is the most widely discussed concept - it is of interest in 67 countries. The Physical Internet concept is discussed in 31 countries but the Logistics 4.0 concept only in 10 countries. The interest in Industry 4.0 is twice larger than in Physical Internet and almost 7 times larger than in Logistics 4.0. This is accompanied by the fact the interest in Physical Internet was 3 times larger than in Logistics 4.0 (details in table 2).

Table 2: Countries of main author

Physical Internet		Industry 4.0		Logistics 4.0	
Country	No of papers	Country	No of papers	Country	No of papers
France	44	Germany	753	Germany	3
Canada	18	China	161	Poland	2
United States	16	Italy	152	Norway	1
China	10	United Kingdom	115	Portugal	1
Germany	7	Austria	99	Russian Federation	1
Hong Kong	6	United States	97	Serbia	1
Tunisia	5	Spain	94	Slovakia	1
Japan	4	Taiwan	64	United States	1
Netherlands	4	Portugal	60		
United Kingdom	4	Czech Republic	47		
Hungary	3	France	42		
Saudi Arabia	3	Brazil	39		
		Poland	38		
		Sweden	37		
		Russian Federation	30		
		Switzerland	30		
		Norway	29		
		Slovakia	29		
		South Korea	25		
		Hungary	22		
		India	22		
		Australia	20		

One might draw the following conclusions by analysing the detailed results in a general scale and focusing on positions of the leading concept in the concepts of four countries. The Industry 4.0. concept is of interest in about a half of the countries (67) worldwide whereas Germany (1), Italy (3), Great Britain (4) are on leading positions in Europe and China (2) in the rest of the world (cf. the names of 22 countries, then there are positions of particular countries in the ranking in brackets). In such a narrow and broader context (generality), the unquestionable domination of European countries is apparent. The Physical Internet concept is also widely discussed worldwide (cf. the scope of 12 countries), but in this case, it is possible to mention the functioning of 3 strong national centres: France (1), Canada and the United States (2 and 3) and China (4). As regards to the Logistics 4.0 concept, it is quite an interesting phenomenon. One might hypothesise that Logistics 4.0 is presently considered to be a European domain (consciously omitting one 1 publication from the United States). In this case, Germany (3) and Poland (2) are the concept leaders. It is interesting that both countries are mutual neighbours which might indicate their similar tradition and such research topics. As far as Germany is concerned, attention is paid to the "Industry 4.0 vs. Logistics 4.0" relationship - interdependence of both concepts. As to other countries, this relationship is not coherent if the ranking position is adopted as a criterion.

As regards to the scientific domains, where the articles on the Physical Internet, Industry 4.0 and Logistics 4.0 concepts are located, two domains Computer Science (1) and Engineering (2) are always in the first row (see Table 3). In the case of Physical Internet, the order of domains is like the above one and in the case of Industry 4.0 and Logistics 4.0, it is reverse (1 – Engineering, 2 – Computer Science). In the authors' view, the above facts confirm the interdependence between Industry 4.0 and Logistics 4.0 again but in another context of considerations.

Table 3: Scientific domains

Physical Internet		Industry 4.0		Logistics 4.0	
Scientific domains	No of papers	Scientific domains	No of papers	Scientific domains	No of papers
Computer Science	56	Engineering	1399	Engineering	7
Engineering	54	Computer Science	1002	Computer Science	5
Decision Sciences	22	Business, Management and Accounting	342	Social Sciences	3
Business, Management and Accounting	21	Decision Sciences	308	Energy	2
Mathematics	8	Mathematics	259	Business, Management and Accounting	1
Social Sciences	7	Materials Science	251	Materials Science	1
Physics and Astronomy	4	Social Sciences	132	Mathematics	1
		Physics and Astronomy	105	Pharmacology, Toxicology and Pharmaceutics	1
		Chemistry	85		
		Chemical Engineering	62		
		Energy	60		
		Economics, Econometrics and Finance	47		
		Environmental Science	34		
		Arts and Humanities	21		

As to the second row, attention should be paid to the occurrence of such domains as Decision Sciences Business (3) and Management and Accounting (4). Such an order is typical of Physical Internet, the domain order is reverse in the case of Industry 4.0. As part of Logistics 4.0, there are brand new, completely different domains on the third and fourth position on the scientific domain ranking.

3.3 Quantitative analysis of publications from Poland

In the case of Poland, Industry 4.0 is a leader in the criterion of the publication number as Industry 4.0 is represented by 38 articles published between 2015 and 2018 (2,4,18,13, respectively). Therefore, a dynamic increase in the publication dynamics is apparent at the same time. The remaining concepts are of definite less and niche interest. Logistics 4.0 is represented by only two 2018 articles. Physical Internet is represented by only one article (2015). The structure of interest in these three particular concepts in Poland corresponds with the interest in these concepts worldwide (first of all, with respect to the publication number structure, the similar tendency is assumed to be true for the publication dynamics based on the Industry 4.0 results).

As regards to the scientific domains in which the published articles are placed, Industry 4.0 represents the broadest scientific scope – 9 domains. In the case of Industry 4.0, the pivotal scientific domains are: Engineering and Computer Science – 2 works belong to each of them. Physical Internet is represented by one work in the Engineering stream. The structure of scientific domains in Poland with regard to 3 concepts in consideration corresponds with the structure of scientific domains worldwide with subtle (minimum) differences (cf. Logistics 4.0, Physical Internet) with no accurate influence on the final outcomes.

In conclusion, the global knowledge and development state of the Physical Internet, Industry 4.0, Logistics 4.0 is also confirmed by the knowledge and development state of these concepts in Poland.

4 Comparison of national economies

The next part of analyses will be related to the GDP increase dynamics in countries where these concepts are being developed. Before the analysis results have been presented, it is necessary to select the space and time scope of the entire research. According to the presented concept development as identified based on the publication number in the Scopus database, the period of time from 2015 to 2017 was the most dynamic (the year 2018 has not finished yet, therefore, it is impossible to obtain its GDP data). As regards to the space scope, the comparative analysis was decided to include countries with the highest number of publications that occur by means of using at least 2 of 3 analysed conceptions (the occurrence frequency was, as follows: Germany 3, United States 3, China 2, France 2, Hungary 2, Norway 2, Poland 2, Portugal 2, Russian Federation 2, Slovakia 2, United Kingdom 2). The comparison analysis will be performed for the EU countries (United States, China and Russian Federation will be then omitted). As a EU member state, Poland has a economic, legal and

environment conditions similar to other EU countries. It is beyond the authors' interest to compare Poland with the omitted countries.

The authors began by analysing the correlation between the number of publications from a given country with its gross GDP. The Pearson's correlation indicator was 0.733 in this case which is accompanied by $p\text{-value}=0.039$. This indicates there is a really strong correlation that exhibits objective statistical regularity features. GDP in chosen countries is presented in figure 1.

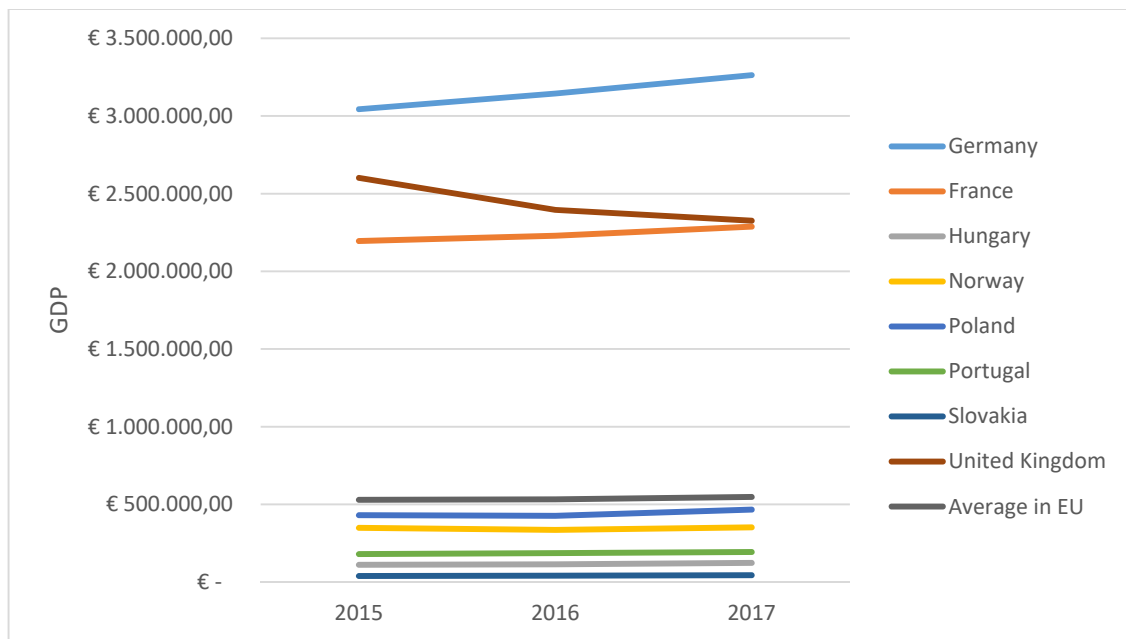


Figure 1: GDP in chosen countries

This might also indicate that the analysed concepts get more intensely developed in countries with higher GDP values. It would be a misuse to make such a reverse interpretation that the concept development influences the GDP values. Nevertheless, the richer countries tend to opt for the digitalisation of economy. This might also indicate an interesting direction for Poland's development.

While analysing the annual GDP increase dynamics in the years 2015-2016, 5 countries had positive results, 3 negative results: the top increases were reported in Slovakia (4.1%), the top decreases were in Great Britain (-7.9%). As for Poland, the change was reported to be -0.9% and the EU average 0.7%. While analysing the annual GDP in the years 2016-2017, positive results were reported in 7 countries, a negative one in 1 country: the top increases were reported in Poland (9.3%) and the top decreases were reported in Great Britain (-2.9%), the EU average -2.8% (see figure 2).

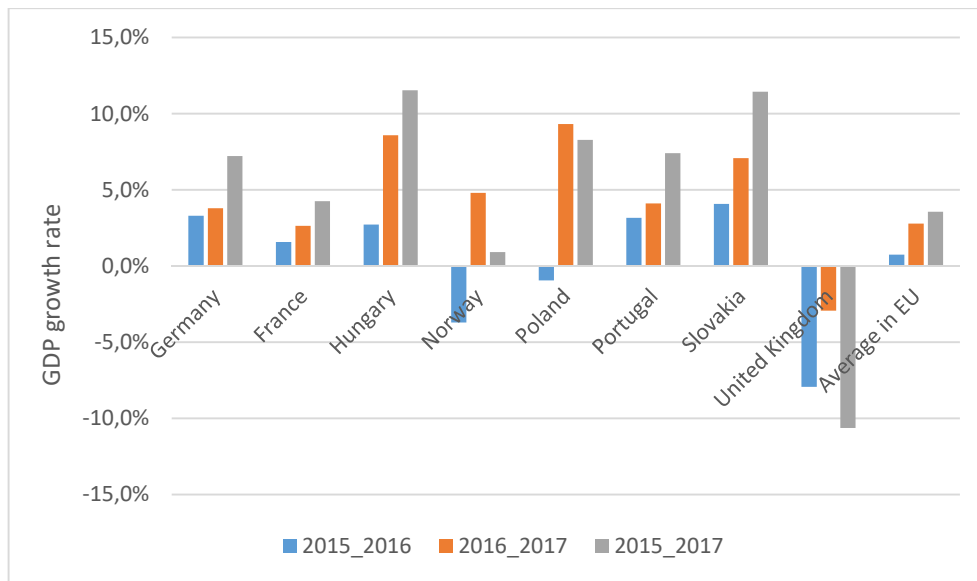


Figure 2: GDP growth rate

While analysing GDP as a comparison of the data in 2015 and 2017, positive results were reported in 7 countries, a negative one in 1 country: the top increases were reported in Hungary (11.5%), the top decreases were reported in Great Britain (-10.6%). As for Poland, the change was reported to be 8.3% (3rd position in the ranking [?]), the EU average 3.6% (see fig. 2).

As indicated by the obtained results, it is remarkable that the Physical Internet, Industry 4.0, Logistics 4.0 might be an incentive to continue growing the welfare of the countries. The countries with lower GDP values tend to develop faster. Nevertheless, it is necessary to maintain stable development in highly developed economies too. The government authorities, who are responsible for managing national and the common EU economy, should be interested in supporting and keep developing these concepts.

5 'Responsible Development Plan'

5.1 Description of the 'Responsible Development Plan'

The Responsible Development Plan (RDP) is intended to indicate key long-term development directions in which one will take numerous actions to intensify Poland's economic potential. The RDP implementation will result in forming a strong Polish industry, complex and coherent investments and an institutional and legal environment that will be favourable to creating, strengthening and expanding Polish business activities abroad. This will be accompanied by using both national and foreign resources effectiently. In the Responsible Development Plan (RDP), one supports the cooperation of science, education and business representatives with particular emphasis on intelligent specialisations. Such cooperation will make it possible to form a permanent basis of Poland's modern, balanced and competitive economy based on innovative solutions. The Responsible Development Plan

(RDP) is also a plan to improve the situation at the labour market and will result in improving living conditions of Polish people according to the rule of worthy work fully adapted to employees' qualifications with honest remuneration. Poland's expected economic and commercial growth should also be in line with social solidarity values. In order to perform the full RDP implementation one needs involvement, a wide-scale interdepartmental cooperation and an intensified social dialogue with business people for the sake of identifying their needs and enabling current monitoring of the influence of undertakings executed within the Responsible Development Plan on the situation of small and medium-sized companies. (Council of Ministers Resolution No. 14/2018).

The situation diagnosis made it feasible to identify strategic challenges that might be specified by the formula of 5 development pitfalls (Responsible Development Plan, Press information):

1. average income pitfall,
2. no balance pitfall,
3. average product pitfall,
4. demographic pitfall,
5. institutional weakness pitfall.

As all the present growth factors have been exhausted, Poland needs a new economic development model. The responsible development should be based on 5 pillars (Responsible Development Plan, Press information):

1. reindustrialisation,
2. development of innovative companies,
3. capital for development,
4. foreign expansion,
5. social and regional balanced development.

In each of 5 pillars specific solutions are proposed - i.a. (Responsible Development Plan, Press information):

- Polish Development Fund,
- support for export and economic diplomacy reform,
- development programmes for particular industries,
- development packets for business people,
- packets for innovation,
- intelligent competitive tenderings,
- vocational schooling reform,
- better quality of EU funds.

The plan is of directional type. The government will successively execute the announced projects. Their objectives are ambitious but real. Their execution advantages are: a hard-working and enterprising nation, Polish technological thought, incredibly skilled young people, absolutely necessary know-how and properly educated staff.

5.2 Place of analysed conceptions in 'Responsible Development Plan'

A detailed RDP analysis will be presented (see below) in accordance with the considerations made in this publication. The analysis will be related to 3 contemporary economy development concepts as presented in the considerations: Physical Internet, Industry 4.0 and Logistics 4.0.

In the Responsible Development Plan, there is no reference to the Physical Internet concept. However, the plan authors notice there is a necessity to fulfil another concept which is the Internet of Things (IoT). In the RDP authors' view, IoT is an important indicator of forming economic processes. Presently, there are 3 technological revolutions - i.a. the digital one (e.g. the Internet of Things), which will decide, among other things, how the future global economy will be shaped and what Poland's position in the future economy will be (Responsible Development Strategy)

One of the main areas of focusing actions in the Polish economy digitation area is to get manufacturing systems based on the Internet of Things technologies widespread. The infrastructure restructuring and integration based on the IoT market development prognoses will be a significant element of creating conditions that will make it feasible to include companies of all sectors/industries in the industry digitalisation process. The development of ICT technologies and a wide-scale implementation of sensors based on information received from the ICT technologies and control systems (within the Internet of Things) will contribute to establishing new models of controlling e.g. movement, transport, energy use and will have an impact on forming new manufacturing models in other industry branches. What is of key importance in the Strategy, is as follows:

- (1) formation of integrated digital network infrastructure that will enable the economy digitalisation and development of broadband access to both the stationary and mobile Internet of the Internet of Things) and Physical Internet and
- (2) development of ICT technologies and a wide-scale implementation of sensors based on information received from the ICT technologies and control systems (within the Internet of Things) - as part of this subproject implementation one will use a national development potential of the ICT sector (Responsible Development Strategy).

As to the actions related to digitising the Polish economy as mentioned in the Strategy, they are most frequently IoT-based services that rely on the mutual interconnection of numerous devices and machines (so-called M2M) and transmission of information received by means of special sensors. Such services are already nowadays applied in such branches as industry, energetics, transport and logistics in highly developed countries. At this point, it is significant to quickly communicate data and process information on a massive scale almost in the real time (Responsible Development Strategy). The ICT technology development is an absolutely necessary component of the Polish digital economy aspects. The ICT technology development stimulates the dynamic economy growth and brings new values to all the economy segments, e.g. as to the industry, it is possible to maintain the position of European innovation in the manufacturing area by using the Industrial Internet of Things (Responsible Development Strategy).

In the Responsible Development Plan, Industry 4.0 is the most strongly represented concept. The RDP authors notice that the economy is presently entering the 4th Industrial Revolution stage known as Industry 4.0 based on modern ICT networks (stationary and mobile). The networks are absolutely necessary to perform further digitalisation and thereby, the economy innovation and acceleration or the increase in the resource usage efficiency. In the segment of services for business, most solutions implied by Industry 4.0. are solutions fulfilled only by means of advanced mobile techniques. The digitalisation role and significance was included in the Strategy within a few projects dedicated to this pillar (the projects will be mentioned by their names) (Responsible Development Strategy).

In the RDP authors' view the technological advancement manifested by the growing digitalisation and automatisisation of economic (and social) processes will have an influence on limiting the general demand on labour or, more likely, will impact the demand structure. This might lead to the labour market polarisation. As a result, human work will be displaced by modern technologies. This will be accompanied by the Industry 4.0 concept development, which is one of the RDP areas of highest priority and is of key importance to improve the Polish economy competitive position. The demand on employees with new skills and qualifications will rise at the same time.

One undertakes actions planned to be finished by 2020 that will focus on activating numerous initiatives, i.a. the activation of the Polish "Industry 4.0" platform that will support the industrial transformation proces oriented to digitising technological and managerial processes in companies. This is with regard to increasing the industry ability to face up global competition. The actions in favour of the Polish "Industry 4.0" platform functioning improvement are foreseen to be continued after 2020 (Responsible Development Strategy).

As far as the technical infrastructure and competence development for "Industry 4.0" is concerned, a significant role in stimulating actions in favour of industrial transformation should be played by a common initiative of public administration and industry, business and science entities. By analogy to other European countries, the initiative will rely on establishing a specialised platform that will inspire and support business people to develop and implement new business models based on the Industry 4.0 concept by means of the platform scope of knowledge, competencies and experience. One of the platform actions is to initiate, integrate and support the initiatives oriented to transforming the national industry to the Industry 4.0 level, particularly to creating a national database of competences for the sake of the transformation fulfillment. This was granted with the strategic project rank called "Polish Platform Industry 4.0" and called a national integrator responsible for getting the national industry transformed to the level specified as Industry 4.0 (Responsible Development Strategy).

It is also anticipated by the Responsible Development Plan to support vocational education for Industry 4.0. The Polish economy demand for skills, qualifications and competencies will be specified by trends at European and global markets which are also currently present at the Polish labour market. There will be a continuous increase in the expectations related to the education quality at all educational levels required from employees. Therefore, there is a need

for a better long-term adaptation of the employees' skills and qualifications to the requirements implied by the so-called Industry 4.0 model. The increase in the requirements at all employment levels is forecasted. One of the actions is to support vocational education for evolutionary needs of industrial changes that will be compared in the strategic project entitled "Modern Staff for Polish Industry" (vocational schools) - a complex staff development policy that will regard a new model of cooperation between vocational schools with economy. This will include i.a. education combined with occupational practice with an employer, active industry participation in preparing school curricula, development of Practical Education Centres, module educational offer, vocational qualification courses, etc. (Responsible Development Strategy).

In the Responsible Development Plan, there is no direct reference to a detailed concept, e.g. Logistics 4.0. Much attention is devoted to mere Logistics as a significant branch of the Polish economy. The interconnection of logistics and the Polish economy digitalisation necessity seems to correspond with the Logistics 4.0 concept authors' postulates.

It is supported by the strategy that there is a successive increase in the significance of the transport and logistics sector for the Polish economy. In 2015, the sector generated approximately 6.5% of gross added value (the average sector participation in the economy is 5.6% in the years 2000-2015) (Responsible Development Strategy). In the RDP authors' view, the intermodal transport development in Poland is unsatisfactory in spite of improving the entire logistic infrastructure and adapting it to the European standards. The average density of distributing containership terminals per the country surface does not differ from the European average density but it is apparently lower than the average one in the case of the countries with the highest market share of intermodal portages. Apart from the reported demand size, the sector development is mainly hampered by an insufficient number of so-called logistic centres, which should offer additional services alongside reloading services, a bad rail infrastructure shape, and high costs of accessing the infrastructure (Responsible Development Strategy). It is mentioned by the strategy that one will undertake actions to rebuild the transport feasibilities of Polish waterways (particulary Oder and nether Vistula). River transport will be promoted as a competitive and low emssive means of transport, i.a. in the so-called urban logistics (Responsible Development Strategy). One of the actions is to develop the intermodal transport supportive infrastructure, in particular by further development of the potential of Polish logistic centres – support for modernising the offered services (Responsible Development Strategy).

In Poland, there is no entity that monitors the IT technology state on a daily basis. The present regulation model is not adequate for the challenges implied by the development of digital technologies. In Europe, there are 2 main models of integrating the competences of regulatory organs competent of digital technologies. The integration of competencies focused on a digitised phenomenon in a broad sense is assumed by the first model. As to the second model, digital and ICT services are combined with network logistics in a broad sense related to common services for citizens: rail, mail and energy. Based on the models as mentioned above, one should develop an optimal solution for Poland. This will enable dynamic development of intrastructure, ICT services which will make it possible for Polish

business people to be efficiently competitive at the global market. At present, the digital market participants do not have equal access to information as a basic value carrier. The regulator's role is to provide optimal access to information on the demand of the digital service market. The ICT technology development stimulates the dynamic development of all economy segments and brings new value to them. Attention is paid by the strategy within transport and logistics to intelligent logistic centres. Due to the IT technology application, the centres enable access to information in real time, analysis and processing of the information between the supply chain participants (Responsible Development Strategy).

6 Conclusions

To conclude, the authors positively verified the hypothesis that countries with better developed economies (with higher GDP) are more interested (as measured by the number of publications in the Scopus database) in developing the Physical Internet, Industry 4.0 and Logistics 4.0 concepts. This was in the first part of the publication. Thereby, the authors proved that these were the leading development concepts of highly developed countries and ones of the most significant solutions in the economy digitalisation domain. This conclusion was complied with the diagnosis of the Polish economy and its development direction presented in the document entitled "Responsible Development Plan". It turns out that the significance of the mentioned concepts (particularly Industry 4.0, which includes Logistics 4.0) is noticed and the Polish economy is directed to their application in the "Responsible Development Plan". Nevertheless, the authors pay attention to quite a general kind of the mere plan. It is required by the economy digitalisation with benefits from the 4th Industrial Revolution to put a number of very detailed postulates in practice. The postulates range from infrastructure to staff training. Although these elements are mentioned in "Responsible Development Plan", there are no detailed plans of their implementation.

From a scientific view point, a significant aspect will be to conclude the plan execution after 2020 has finished. The conclusion will particularly regard the aspects related to fulfilling the Industry 4.0 postulates. In the long term, it will be possible to investigate the economy digitalisation influence on citizens' living standards. It will turn out then, whether the plan was a properly written wishful diagnosis or a ground-breaking document constituting the fact the Polish economy would avoid the average growth pitfall.

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References

- DHL, 2015, *Internet of Things in Logistics*, Retrieved from: http://www.dhl.com/content/dam/Local_Images/g0/New_aboutus/innovation/DHLTrendReport_Internet_of_things.pdf [accessed on 18.02.2017]
- Domański R., Adamczak M., Cyplik P. 2018, Physical internet (PI): a systematic literature review, *LogForum*, 2018, 14 (1), 7-19
- Hompel, M., Kerner S., 2015, Logistik 4.0 Die Vision vom Internet der autonomen Dinge [The vision of the autonomous Internet of things], *Informatik Spektrum*, 38(3), 176-182. DOI:10.1007/s00287-015-0876-y
- Jeschke S., 2016, *Quo Vadis Logistik 4.0*, Retrieved from: http://www.ima-zlw-ifu.rwth-aachen.de/fileadmin/user_upload/INSTITUTSCLUSTER/Publikation_Medien/Vortraege/download//Quo_vadis_Logistik4.0_17March2016.pdf [accessed on 18.02.2017]
- modulushca.eu (15.05.2017)
- Montreuil B., 2006, The Physical Internet. A survey of logistics, *The Economist*, 1-15
- Montreuil B., Rouges J.F., Cimon Y., Paulin D., 2012, The Physical Internet and Business Model Innovation, *The Technology Innovation Management Review*, 32-37
- Pfohl H.Ch., Yahsi B., Kurnaz T., 2015, The impact of Industry 4.0. on the supply chain, 31-58. DOI: 10.13140/RG.2.1.4906.2484 w: Kersten W., Blecker T., Ringle Ch.M., Innovations and strategies for logistics and supply chains. Technologies, business models and risk management, *Proceedings of the Hamburg International Conference of Logistics*. DOI: 10.15480/882.1264
- Plan na rzecz Odpowiedzialnego Rozwoju, Informacja prasowa*, Ministerstwo Rozwoju, 16 lutego 2016 r. http://www.mii.gov.pl/media/14827/Plan_na_rzecz_Odpowiedzialnego_Rozwoju_informacja_prasowa.pdf [access 15.04.2018]
- Prause M., Weigand J., 2016, Industry 4.0 and Object-Oriented Development: Incremental and Architectural Change, *Journal of Technology Management & Innovation*, 11(2), 104-110. DOI: <http://dx.doi.org/10.4067/S0718-27242016000200010>
- Rennung F., Luminosua C.T., Draghicia A., 2016, Service Provision in the Framework of Industry 4.0, *Procedia - Social and Behavioral Sciences* 221, 372 – 377. DOI: 10.1016/j.sbspro.2016.05.127
- Strategia na rzecz Odpowiedzialnego Rozwoju, Ministerstwo Rozwoju*, Warszawa 2017 <http://www.mii.gov.pl/media/48672/SOR.pdf> [access 15.04.2018]
- Szozda N., 2017, Industry 4.0 and its impact on the functioning of supply chains, *LogForum*, 13 (4), 401-414
- Szymańska, O. , Adamczak, M. , Cyplik, P., 2017 Logistics 4.0 - a new paradigm or set of known solutions? *Research in Logistics & Production*, Vol. 7, No. 4, 299-310
- Timm J., Lorig F., 2015, Logistics 4.0 – a challenge for simulation, *Proceedings of the 2015 Winter Simulation Conference*, IEEE Press Piscataway, NJ, USA. 3118-3119. DOI: 10.1109/WSC.2015.7408428
- UCHWAŁA NR 14/2016 RADY MINISTRÓW z dnia 16 lutego 2016 r. w sprawie przyjęcia „Planu na rzecz odpowiedzialnego rozwoju” - RM-111-18-16, <http://www.mii.gov.pl/strony/strategia-na-rzecz-odpowiedzialnego-rozwoju/plan-na-rzecz-odpowiedzialnego-rozwoju/> [access 15.04.2018]
- Wang K., 2016, Intelligent Predictive Maintenance (IPdM) system – Industry 4.0 scenario, 113, 259-268. DOI:10.2495/IWAMA150301 in: Wang K. et al., 2016, *Advanced manufacturing and automation V*, WIT Press, Southampton
- Wang S., Wan J., Li D., Zhang Ch., 2016, Implementing Smart Factory of Industrie 4.0: An Outlook, *International Journal of Distributed Sensor Networks*, 16(7), 1-10. DOI: <http://dx.doi.org/10.1155/2016/3159805>

The dynamics of knowledge in Public Private Partnerships – a sensemaking based case study

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Abstract: Around 1996 the notion of long term, ongoing partnerships between public service organisations and private companies, particularly in the field of infrastructure, was born. Since then PPPs have proliferated. Seen as a new form of organisation, it triggered a large number of studies. Most approach the phenomenon from the perspectives of economics, finances, and organisational behaviour. But virtually no study analyses PPPs in terms of the *knowledge dynamic* inside a PPP. This paper reports on a case study in South Africa in this respect. The sensemaking Theory of Karl E Weick serves as the interpretation framework. The case analysis covers the period 1998 to May 2018. After a bird’s eye view of the case history, the paper briefly discusses the most significant manifestations of the knowledge dynamic.

Keywords: PPP, knowledge dynamics, distributed knowledge, ambiguity, equivocality

1 Public Private *Partnerships* – the organisation of a new public engagement with private enterprise and civil society

Public Private Partnerships (PPPs) have multiplied over the last two decades (Sarmiento & Renneboog 2016). As their number increased, analyses increased too. (A search for peer reviewed, online articles since 2015 yielded 17 730 entries alone). They are described as hybrids, controversial, complex (Villani et al 2017, Wu et al 2016) and even expressions of “public failure” (Smith 2010). Arguments in favour include better overall quality of public service delivery (Cheung et al 2009, Lammam and MacIntyre 2013), higher levels of creativity and value as a consequence of the diversity of skills and insights inherent to a PPP (Villani et al 2017), and relief to the public purse (at least in the capital formation stage) (Sarmiento and Renneboog 2016).

Despite the many studies PPPs remain curious phenomena. They do not fit the templates for conventional organisations or for the role of the state. The studies amply show that PPPs are no partnerships of like-minded participants. It is more a forced partnership of expedience. Even so, it is a *partnership* and not simply an outsourced service to the state. Given the multi-decade character of these relationships it is appropriate to see them as a new form of organisation (Villani et al 2017, Rao et al 2003).

Consequently, a fair number of recent analyses investigate PPPs from typical organisational

perspectives such as workflow, trust, financial discipline, accountability and other aspects of governance, information asymmetry, value creation and general strategizing (Sarmiento& Renneboog 2016, Verweij et al 2016, Benítez-Ávila 2018, Stadtler 2016, Lammam and MacIntyre 2013, Hueskes et al 2017, Parker 2018, Zhang 2016). These add to the earlier analyses of the financial and general economic dimensions of PPPs.

Noticeably absent, however, is studies of PPPs on the basis of knowledge management considerations. This is curious as PPPs typically revolve around high level and advanced skills and scientific as well as organisational knowledge. In fact, only one attempt to understand the phenomenon of PPPs as a *structural system of knowledge engagement* could be found. Employing a very rigorous cybernetic framework, based on the work of Stafford Beer, Yolles and Iles (2006) present an analysis which is conceptually rich but difficult to replicate in practice. Clearly the knowledge dynamics, and indeed other dimensions of knowledge processing, in PPPs, is under-researched. Many studies report malfunctioning in PPPs. This paper postulates that an important (and perhaps decisive) reason for such malfunctioning is a *knowledge disconnect* that is inherent in the current organisational model of PPPs.

2 Objective and methodology

The knowledge disconnect is demonstrated and analysed by means of a case analysis of the South African energy generation PPP which was initiated in 1998 and is still ongoing. The analysis draws on the period 1998 to May 2018.

The analysis is directed by the sensemaking theory of Karl E Weick (Weick 1995). Sensemaking theory provides the framework to analyse the cognitive processes of understanding and decisionmaking in situations of ambiguity and cognitive dissonance. The Weickian version of sensemaking theory is specifically directed at organisational contexts.

The paper highlights key features of the dynamics of knowledge in a PPP, seen as an organisation, when it is subjected to high levels of ambiguity and cognitive dissonance. It is probably not unfair to assume that most PPPs on the scale of the case presented here, will show similar features.

3 Overview of the South African energy generation saga

3.1 General background

As of April 2018, South Africa (SA) generates the 20th most electricity in the world. This is an inheritance from, first gold and then platinum, mining since 1886. Possessing the 6th largest deposits of coal in the world made coal fired stations attractive and cheap in the 20th century. By the early 1990's SA offered the cheapest electricity in the industrial world. Since 2008 the cost has increased significantly but is still the 9th cheapest. (Deloitte 2017)

Presently SA is the world's 5th biggest mining economy and its unmined mineral deposits was valued at 3 trillion USD in 2012 (excluding large gas deposits and minor oil fields). To mine

these, as well as to support a well developed digital economy and some heavy industrial activities, obviously requires an extensive electricity capacity.

Furthermore, as the country moved away from apartheid, huge infrastructure investment, including electricity provisioning, was (and still is) needed to compensate for the neglect of the majority of the population during the apartheid regime in the 20th century. Thus, on top of maintaining provisions for a growing industrial economy, additional, catch-up, power needs to be generated. In 1989 the aim was stated to double generation capacity in the next 20 years. At the same time old (coal) power stations were running out of lifetime. Not only was large expansion required but also large scale replacement. The cost is immense.

However, the question how to expand the electricity infrastructure is far from self evident. Unlike most other countries SA has a long list of options, each with its protagonists and opponents.

Firstly, together with Namibia, SA is a dominant player in uranium mining (having constructed 6 nuclear bombs during the 1980's, but they have since been dismantled). It hosts the only nuclear generation plant on the African continent. Secondly, SA ranks as one of the countries with the highest photovoltaic penetration on earth and at times is dubbed the future "solar energy capital of the world". Thirdly, the country has a practical monopoly (with Zimbabwe) on the world's platinum stock. This is important if cell fuel technology proves to be commercially viable in future. State sponsored research in this respect between 2007 and 2017 reported substantive progress (Campbell 2017). Fourthly, the country possesses large quantities of untapped gas (according to American estimates perhaps the 5th most globally). At present gas turbines are used for electricity generation, but the gas is imported from Mozambique.

Fifthly there is INGA, the hydro-generation project in the world's most voluminous waterfall in the Congo river in the Republic of Congo. According to studies by the World Bank (and others) the potential generating capacity of INGA exceeds the Three Gorges project in China. It has the potential to provide 50% of Africa's electricity needs. Support for INGA was always the policy of SA and in 2014 a treaty was signed with the Congo guaranteeing a substantive uptake of electricity when Inga is completed. However, in 2016 the World Bank withdrew and the latest indication is that the project has been postponed to 2024.

Yet, the bulk of electricity generation still comes from coal fired stations. The social and physical infrastructure supporting coal generation is hardwired in the economy. Moving away from coal generation will have a major impact on employment, mining and export earnings. On the other hand, environmental concerns are pressing too. The SA government (being a member of the G20) is an enthusiastic supporter of the Kyoto Protocol and the Paris Accord. Already in 1997, the Clean Development Mechanism was promulgated. In 2004 the Designated National Authority to oversee the reduction of green-house emissions was enacted. In time large parts of informed civil society came to throw their weight behind "clean" technology, but trade unions vehemently support coal generation.

Since 1937 electricity generation and distribution in SA has been a monopoly of the company ESKOM of which the state is the only shareholder. Until 1990 it enjoyed considerable

autonomy, but since the democratic constitution of 1996 it became an essential part of government's model for economic development. It was then that the relationship between Eskom and the state began to be seen and promoted as a PPP. As a consequence, Eskom being both a public and a private company became subjected to both private and public regulation. The net effect is that it has no leeway for any form of competitiveness, innovation and flexible business practices and since 1998 became a yo yo in the hands of successive administrations.

3.2 The energy saga in SA - a brief case history since 1998

The government of Nelson Mandela published in 1998 the first *White Paper on the Energy Policy of the Republic of South Africa*. It was crafted by a number of highly regarded experts and presented a plan based only on expert scientific and financial principles. It proposed a mix of energy sources, including nuclear, coal and wind, but already then anticipated important technological changes that would make photovoltaic generation increasingly preferable. Cell fuel technology was not on the radar yet. Among others it proposed an Integrated Resource Plan (IRP) to be *annually* updated by a permanent expert technical unit in government to accommodate technological advances. Government accepted the proposal, but failed to staff and finance the unit properly. In the years to come the IRPs were to become the converging point of all disputes.

Over the years the IRPs morphed into a barometer of which political conviction held sway at the time, albeit clad in formal and technical language. During the Mbeki administration (1999 to 2008) virtually no capacity increase took place. He openly set store on the development of the Inga project. This, to him, was an important ingredient of the "African Renaissance". In 1999 Eskom informed government that the generation ceiling would be reached by 2008. Since government ignored the 1999 warning, severe load shedding had to be implemented. After stabilising the electricity situation hasty plans were made to build two new coal fired generation plants. They are to be the biggest dry-cooled plants ever in the world. Operations were to start in 2012. In fact, only one became partially operational in 2016. By then its initial budget had been exceeded by 240%. Its full operation is expected to be in 2020. The second plant is not expected to begin operations before 2023.

The delay was caused by labour unrest, a change of contracts with major suppliers, subsequent court cases, and a growing public unease with perceived corruption. But all of these were symptoms of the political change of focus that came with the Zuma administration (2008 to 2018). The function of Eskom was promptly changed to be the spearhead of government's political objective of "Black Economic Empowerment". Business skills and scientific expertise got replaced by political obedience. A massive brain drain ensued which ultimately led to large scale failure of electricity production in 2015.

This time the electricity grid almost imploded. A so-called "war room" had to be set up as experts were imported from business and universities to salvage the situation. Months of load shedding followed with a severe and long-lasting impact on the country's economic fabric. Manufacturing and mining was reduced and in 2017 SA entered a recession followed by a string of ratings downgrades. But the situation also triggered a wave of energy saving

measures by individuals and companies. Independent Energy Providers emerged. Solar and wind farms sprung up, and the dream of Inga was rekindled. By 2018 approximately 10% of power came from renewables generated by independents.

Meanwhile since 2010 the Zuma administration was on a nuclear mission, which became formalised in the 2012 IRP. No further IRPs were issued since then. After a while it began to dawn on society that the choice was less on the grounds of science and more according to a political shift toward Russia. Resistance erupted. Growing opposition in the ruling party led to the sacking of a succession of Energy and Finance ministers in the next 5 years. Employing a PR company in the UK (Bell Pottinger) the pro-nuclear group ran a social media campaign which, in hindsight, is to be classified as “ideological fake news” (similar to what happened prior to the Brexit vote and the 2016 USA elections). This was countered by large scale civil protests and eventually led to a court judgement which nullified the Zuma attempt to negotiate a nuclear deal with Russia, the eventual ousting of Zuma and large investigations into “state capture” (Basson 2018, Du Toit 2018). Shortly after Zuma’s ousting a promise was made to publish a “new” IRP later in 2018. Initial indications are that solar and wind will replace nuclear as the core focus. After 6 years of bungling, the saga is set for a new phase.

4 The dynamics of knowledge in PPPs

It is a big mistake to ascribe the saga purely to “politics”. It is, at the same time, the question how modern societies and governments “of the people” cope with a technological world which runs on complex knowledge which far exceeds the comprehension of the politicians. Therein lies the seeds of the knowledge disconnect in PPPs.

4.1 Distributed knowledge in a distributed organisation

Key to understanding the dynamics of knowledge in this situation, is the realisation that the abbreviation ‘PPP’ is shorthand for an organisation which is by nature a *complex distributed system*.

A complex (also called multi-agent) distributed system is one in which *inherently different* agents interact, a) *without there being any central authority* and b) *without there being a need for shared knowledge*. (Woerman and Cilliers 2012). What such a system knows is the sum total of what components know individually, while none of the components in themselves know what the whole knows or duplicate the knowledge of other agents. A good example of such a system is the universe. A more down to earth example is a team in a sport which consists of continuous and simultaneous interaction between a set number of players (football, hockey, rugby, netball).

Central to the complexity understanding of “distributive” is the absence of a centre of authority which comprises the whole. There is no structural centre. In conventional organisational modelling a central point of reference from which radiates lines of communication and control, is taken as self evident. In a complex organisation there is no such a point of reference. What binds it together is a shared commitment to a predetermined objective. The whole is bigger than the sum of the parts, and it is only achieved as all agents

direct their “their own thing” to reaching the objective. This is far removed from a centrally commanded operation. The shared commitment to the objective of the project regulates the agent’s own behaviour, not the actions of other agents.

Distributed systems, therefore, are held together by a shared commitment, but not by shared knowledge or shared systems. It is commitment which allows for a symbiotic alignment of various knowledges and systems toward realising the objective. And even when, in the case of PPPs, it functions like an organisation, there is no organisational structure that binds the actors together other than defining the relationship between them as a *partnership*. In sensemaking terms this amounts to an absence of a unifying identity. The significance of this will become clearer in the next three points.

4.2 The weak correspondence of frames

Weick (1995, 49ff) uses a metaphor of “cues within frames” to describe how the human brain makes sense. Through all sorts of experiences, the brain builds up an array of “frames”. These become reference points when the brain reacts to cues that are encountered at any given moment. If the brain succeeds to fit a cue into a frame, sense was made as the frame had managed to identify the cue. However, if such identification fails, the brain suffers cognitive dissonance and engages in a process of identity construction, either by searching for alternative frames, or by creating a new frame. In everyday parlance, this is known as “changing one’s mind”. (Recent advances in neurological studies of the brain (Eagleman, 2015) show that Weick’s metaphor accords with new physiological insights in the functioning of the brain). In sensemaking terms, therefore, understanding between people depends on the extent to which they fit cues into frames that more or less correspond to each other. The further frames are apart, the more disagreement follows, and vice versa.

In the case under discussion the correspondence is particularly weak. This was already evident in the perfunctory way that the 1989 White Paper was treated. The world of scientific experts was far away from the world of political dreams about dams in far away Congo, the more so because some of the ministers involved on behalf of the government, were exiles in Central Africa less than a decade before.

In the Zuma era the correspondence became even weaker. The suspension of the updating of IRPs was a clear indication that scientific expertise counted for very little. The talk about nuclear served to maintain the pretence of scientific belief while the real motivation was an intended political alignment with Russia. Ironically the emphasis on nuclear led to a spirited discourse between experts on the pros and cons of nuclear. For them the cue “nuclear” triggered scientific and financial frames of reference. In the Zuma administration it triggered the frames of geo-politics in conjunction with “Black Economic Empowerment”. It took a long while for the business community and civil society to recognise the disparity of frames.

When the frames of reference of the Public and the Private partners drift so wide apart as in this case, the door opens for alternative realities and their corresponding “alternative facts”. When civil society began to resist, the pro-nuclear network contracted the UK firm Bell Pottinger to launch an “alternative facts” campaign in social media. Outrageous claims (“agents of the West and counterrevolutionaries”) were cunningly disseminated and society

widely destabilised. Of course, such “facts” had nothing to do any more with nuclear science. Yet, it was widely accepted.

How is “alternative facts” possible? One part of the answer lies in understanding ambiguity.

4.3 Ambiguity and confusion

Ambiguity occurs when people face multiple possible interpretations of events or actions, each option being plausible and acceptable in itself. As Weick (1995, 91) puts it, “ambiguity refers to an ongoing stream that supports several different interpretations at the same time”. To this Weick adds: “The problem in ambiguity is not that the real world is imperfectly understood and that more information will remedy that. The problem is that information may not resolve misunderstandings”.

The case description showed that the SA government faces more energy options than is usual in most other countries. If the choice for an option is based *purely* on technical and financial analyses it is not possible to establish any clear ranking. When the pros and cons of each technology is projected over 50 years or more, the margins between the options turn out to be very small. This is true as long as no consideration is factored in other than the inherent technical specifications of each option. No amount of expert knowledge can, therefore, decide what the most expeditious choice would be among the various options when viewed from socio-economic perspectives.

The result is near perfect ambiguity. On the one hand the country has too many options to choose from. On the other hand, the long time span makes it impossible to anticipate what effects one technology will have, let alone 6 possibilities.

As additional information does not change the situation, but circumstances enforce some decisions and actions, the situation is ripe for equivocality to enter the stage.

4.4 Equivocality

Equivocality is the corollary of near perfect ambiguity. When faced with the cognitive need to act in a situation where a number of possibilities present themselves, each with the same logical weight, equivocality leads to either an “anything goes” outcome, or total paralysis.

Total paralysis was indeed the first reaction during the Mbeki administration. Were it not for the crises in 2007 not even the two new coal powered stations would have materialised. Equivocality without pressure breeds inaction.

But once pressure was felt, the situation shifted to an appropriation of the “anything goes” reaction. As each option is in itself correct, and it is not possible to establish a clear ranking on *scientific* grounds, the coast was clear to make a choice on other grounds. Since the government is tasked to be the final arbiter and majority funder, the “release” from purely technical considerations allowed government to invoke frames of reference that fitted political plausibility at the time.

Of course, this shifts the entire decisionmaking process to a level of subjectivity which is far removed from the pretence of technical objectivity – even though the formal documents

continue to be formulated in technical jargon. The real knowledge base which allows people to make sense in situations of equivocality consists of values, beliefs and subjective orientations. And indeed, making sense of the energy problem through the prism of the “African Renaissance” or “Black Economic Empowerment” turns out to be more plausible to public representatives than the formal expert knowledge of private (and civil society) partners.

4.5 The surprising limitations of expert knowledge

When reading the, by now, vast volume of formal documentation generated over 20 years, one is struck by the near absence of the recognition of the subjective basis of the various views and policies that were expressed and promulgated. It is as if there is a silent conspiracy to pretend that the entire process is one of pure objectivity. Only when Bell Pottinger was contracted in, did the non-expertise-based subjectivity of the pro-nuclear group surface properly. Before then two administrations steered a course, silently, in which formal expertise never dominated.

The fact is that formal expertise, in matters of real ambiguity, is overrated. To say this in standard knowledge management terms: *explicit knowledge, in conditions of ambiguity, becomes meaningless very quickly*. It is from the depths of tacit knowledge that the convictions come that result in action. By pretending that the discourse is one of objective facts, grounded in objective expertise, the real knowledge exchanges and the real grounds for decisionmaking are suppressed to the detriment of the process and outcome.

The relative devaluation of formal technical and scientific knowledge, of the value of expertise in other words, may strike some as surprising. Yet similar observations can be made of the Brexit vote in the UK, of Trump’s America, of events in Greece and Italy recently. The point here is that in conditions of equivocality information provided by experts and expertise merely underscores ambiguity and thus *reinforces* confusion. In fact, it easily comes to be seen as the source of confusion, and thus invites actions to devalue its importance. The freezing of the IRP in its 2012 format and the subsequent rejection of any further expert inputs is an example of such devaluation.

4.6 Ideological versus expert knowledge

We inherit the acronym PPP from the general discourse on the matter. It is coined, clearly, from an actor perspective which is informed by both politics and economics. Two actors are juxtaposed: the state and private enterprise. As long as this paradigm is maintained a PPP seems to be a neat and clearly defined arrangement.

But there is a multitude of problems in such a view. For example, in what way is the ‘state’ in a democratic society such a clearly demarcated entity that it can be juxtaposed to private enterprise (which consists of the very society from which it is born)? As for the third ‘P’, how – in a democratic society – can the representative of society (the first ‘P’) partner with itself (the second ‘P’)?

The point, here, is that the acronym ‘PPP’ does not adequately express the inner dynamic of the reality it denotes. This much becomes clearer when we do not look at the phenomenon

through historically laden categories such as ‘public’ and ‘private’, but focus on the dynamic of knowledge inside an actual PPP. It is very soon clear that there is nothing homogenous (neither over time nor even at a given moment) in either the ‘public’ or the ‘private’. In both camps there is flux of ideas and convictions. And there are many linkages across the two camps too.

The distinguishing factor is neither institutional nor formal, but different type of *subjective* knowledge that are brought to bear on the project. Most (but not all) representatives of government will, in situations of equivocality, revert to political values – in other words ideology – to determine a stance. Most (but not all) representatives of private companies (read: civil society) will revert to technical expertise. This may seem an objective move, but it is not. Technological knowledge itself may be objectively verified, but the personal choice to associate with such knowledge and its organisational employment is a subjective value orientation.

4.7 Distributed ignorance

As noted in 4.1 the distributed nature of a PPP means that no agent (person or collective) comprehends the whole. Each actor is meant to focus on its own area and employ its own knowledge. Knowledge is not shared but distributed. But exactly this means that ignorance is also distributed across the whole. For each person who is an expert in X, that person is ignorant – per definition – in Y, and vice versa.

Conventional wisdom holds that it is government (the first ‘P’) whose responsibility it is to oversee the whole and in so doing make the interlocking of various knowledges possible. But a PPP being a complex distributed system, it is impossible for government (or indeed the ‘Private’) to exercise this role. As a part(-ner) it also cannot know the whole. It suffers from ambiguity like all other parts. As we have seen above, government, thus, reverts to its subjective ideological position when decisions have to be made.

If a PPP is seen in the conventionally formalistic way (definable institutional actors) it follows that government should bear the sole responsibility of final decisionmaking. And under influence of centuries of doctrinal theory building, governments (by claiming to be the state) eagerly assume such an omniscient mind. But if we see PPPs in light of the dynamic of knowledge, then government is not competent to do so. Nor is any single other actor.

The problem of understanding complex knowledge (nuclear, cell fuel, etc), and taking decisions on the basis of such comprehension, is not solved by claiming authority. This holds true for both official and intellectual authority, for both government and the experts. Neither the ‘p’ in president, nor the ‘p’ in professor guarantees correctness or wisdom.

4.8 Tunnel vision – the diminution of cues

For 20 years debates, and sometimes hefty contestations, about the merits or not of various energy generation technologies (and their respective costs) have dominated the SA landscape. Numerous IRPs, even more reports and parliamentary investigations, and countless newspaper columns have been produced.

Yet, the most staggering aspect of it all is the near absence of attempts to model the downstream effects for the economy and impacts on society of each of the possible energy sources. In a modern economy having energy is crucial, but how it is generated is more important. *How* it is generated determines the kind of economy of the country. *How* energy is created impacts settlement of people, their skills development and training, financial flows and investment, technology specialisation, transport needs, in short all of the economy and much of social life. (Consider for instance the difference between a mining based and a cell fuel based energy system).

One would have thought that a comprehensive socio-economic modelling of the larger, downstream impacts would have been made for each of the options. One would have thought that such considerations would have informed the debate. But no such comprehensive and concerted effort was ever made. In stead the IRPs kept on focussing on the available technologies in abstraction; and so did the public debate.

It is a mute question whether the SA government is capable of managing such an enterprise. Broadening the scope of the energy issue in such a way, would add an unforeseeable flood of new cues to an already ambiguous situation. It does not matter that such an investigation is a material part of the problem and solution. More cues would push minds who already cannot cope into total cognitive dissonance. It is then that tunnel vision becomes attractive. It is done by focussing on what is seemingly important (the various technological options), thereby maintaining the pretence of relevance, but in reality trying to escape dissonance.

In situations of ambiguity fewer cues lead to lower capacity to arrive at solutions. More cues, and more deliberation on their significance, on the other hand, open the opportunities for better answers. Simplification of ambiguity and equivocality is impossible.

5 A quick conclusion

The knowledge disconnect in a PPP is not a result of bad management and insufficient information communication. The disconnect is given in the very nature of the divergence of the frames of understanding of the partners.

The crucial task for knowledge management is to devise a *systemic* mode for sophisticated and inclusive deliberation on all possible cues and in doing so to maintain an ongoing clarification process to guide action.

References

Benítez-Ávila, C., Hartmann, A., Dewulf, G., & Henseler, J. (2018). Interplay of relational and contractual governance in public-private partnerships: The mediating role of relational norms, trust and partners' contribution. *International Journal of Project Management*, 36(3), 429-443.

- Basson, A. (2018). Why Ramaphosa should score an A for his first 100 days. <https://www.news24.com/Columnists/AdriaanBasson/why-ramaphosa-should-score-an-a-for-his-first-100-days-20180525>
- Campbell, K. (13 April 2017) South Africa's hydrogen fuel cell programme making steady progress. *Engineering News*.
- Cruz, C. O., & Marques, R. C. (2012). Flexible contracts to cope with uncertainty in public-private partnerships. *International Journal of Project Management*.
- Deloitte. (2017) *An overview of electricity consumption and pricing in South Africa*. An analysis of the historical trends and policies, key issues and outlook in 2017. Report prepared for Eskom Holdings SOC Ltd
- Du Toit, P. (2018). State capture – what Cyril Ramaphosa knew and when he knew it. Huffington Post. https://www.huffingtonpost.co.za/2018/05/28/state-capture-what-cyril-ramaphosa-knew-and-when-he-knew-it-a_23445148/
- Eagleman, D. (2015). *The Brain*. Canongate Books: Edinburgh
- Eberhard, A., Kolker, J., Leigland, J. (2014). *South Africa's Renewable Energy IPP Procurement Program: Success Factors and Lessons*
- Department of Minerals and Energy. (December 1998). *White Paper on the Energy Policy of the Republic of South Africa*.
- Hueskes, M., Verhoest, K., & Block, T. (2017). Governing public-private partnerships for sustainability: An analysis of procurement and governance practices of PPP infrastructure projects: An analysis of procurement and governance practices of PPP infrastructure projects. *International Journal of Project Management*, 35(6), 1184-1195.
- Inga Falls. World Waterfalls Database. <https://www.worldwaterfalldatabase.com/waterfall/Inga-Falls-660>
- Integrated Resource Plan for Electricity. (IRP) 2010 - 2030. (2013) http://www.doe-irp.co.za/content/IRP2010_updatea.pdf
- Lammam, C., & Macintyre, H. (2013). The case for public-private partnerships. *Fraser Forum*, 15-17,14.
- McGraw Hill Education. Grounded Theory Methodology. <https://www.mheducation.co.uk/openup/chapters/9780335244492.pdf>
- Murphy, T. J. (2008). The case for public-private partnerships in infrastructure. *Canadian Public Administration*, 51(1), 99-126.
- National Treasury. (2007). *Introducing Public Private Partnerships in South Africa*
- NER. (2000). *Electricity supply statistics for South Africa 2000*
- Parker, D. W., Dressel, U., Chevers, D., & Zeppetella, L. (2018). Agency theory perspective on public-private-partnerships: international development project. *International Journal of Productivity and Performance Management*, 67(2), 239-259.
- Rao, H., Morril, C., Zaid, M. N. (2000). Power Plays: How Social Movements and Collective Action Create New Organizational Forms. *Research in Organizational Behaviour*. 22, 237-281
- Reynaers, A. M. (2014). Public Values in Public-Private Partnerships. *Public Administration Review*, 74(1), 41-50.
- Sarmiento, J. M., & Renneboog, L. (2016). Anatomy of public-private partnerships: their creation, financing and renegotiations. *International Journal of Managing Projects in Business*, 9(1), 94-122.
- Saussier, S. (2013). Public-private partnerships. *Journal of Economic Behaviour and Organization*. 89. 143-144

- Smith, F. L. (2010). The Problem with Public Private Partnerships. *Competitive Enterprise Institute* (November 2010)
- Stadtler, L. (2016). Scrutinizing Public–Private Partnerships for Development: Towards a Broad Evaluation Conception. *Journal of Business Ethics*, 135(1), 71-86.
- USAID (2018). South Africa – Power Africa Fact Sheet. <https://www.usaid.gov/powerafrica/south-africa>
- Verweij, S., Teisman, G. R., & Gerrits, L. M. (2017). Implementing Public–Private Partnerships. *Public Works Management & Policy*, 22(2), 119-139.
- Villani, E., Greco, L., & Phillips, N. (2017). Understanding Value Creation in Public-Private Partnerships: A Comparative Case Study. *Journal of Management Studies*, 54(6), 876-905.
- Wu, J., Liu, J., Jin, X., & Sing, M. C. P. (2016). Government accountability within infrastructure public–private partnerships. *International Journal of Project Management*, 34(8), 1471-1478.
- Zhang, S., Chan, A. P. C., Feng, Y., Duan, H., Ke, Y. (2016) Critical review on PPP Research – A search from the Chinese and International Journals. *International Journal of Project Management*. Volume 34(4), 597-612
- Boyer, E., J. (2016) Identifying a Knowledge Management Approach for Public-Private Partnerships, *Public Performance & Management Review*, 40:1, 158-180
- Yolles, M., Iles, P. (2006). Exploring Public–Private Partnerships through Knowledge Cybernetics. *Systems Research and Behavioral Science*. 23, 625-646
- Woerman, M., Cilliers, P. (2012). The ethics of complexity and the complexity of ethics. *South African Journal of Philosophy*. 31(2), 447-463.

Cultural Dimensions - The different impacts on Leadership behaviors

How Leadership can be impacted by different Organizational Cultures and have influence on followers

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Abstract: This study explores the concepts of Cultural Dimensions within an organization that are understood as two different ones: National and Organizational Culture. The purpose of the paper, based on Organizational Culture practices, is to discuss How Leadership can be impacted by different Organizational cultures and have influence on followers. Which is the research question. It will lead us to test and validate the impact of Organizational Culture on leadership behavior and his influence on follower's commitment, engagement and inherent results. Previous studies identified six dimensions that will be analyzed under Organizational Culture scope which however should not be confused with the six national culture dimensions and are not necessarily considered as relevant in all regions, countries and all companies or organizations. They are not based on values but on strategic practices, which unlike national values can to some extent be monitored by the organization's management, leaders, with the support of skillful specialist, expertize people or even consultants or coaches. Reinforcing the main purpose of this research mentioning that effective leadership is still largely a matter of behavior and that could be dependent of each Organizational Culture. "Culture" has been (can be) defined "as the collective programming of the mind that distinguishes the members of one group or category of people from others".

Keywords: Organizations, Culture, Leadership, Behaviour

1 Introduction

The present study will address the impact that organizational culture can have on leadership and its influence on followers. We will check what kind of leadership, resonant or dissonant, impacts on the performance of followers.

According with Cunha et al (2010), performance results from the diversity of organizational factors (internal communication, standards of exigency, human resources policy, etc.), leadership (technical and relational competencies of the leader, honesty, more or less autocratic behaviors , etc.), personal (financial situation, emotional status of the worker, relationship between work and family demands, etc.) related to the job position (work load,

type of tasks, role conflict, and the demands of the function, etc.) and external factors (trade union conflicts, economic crises, political, etc.).

Among these factors, this research will address the relationship between leadership and Organizational Culture. More specifically, based on the six styles of emotional leadership proposed by Goleman et al. in "The New Leaders. Emotional Intelligence in Organizations" (2002) (visionary leaders, counselors, democratic, relational, pressurists and dirigiste), this research is based on the following starting point:

How Leadership can be impacted by different Organizational cultures and have influence on followers.

2 Theoretical base

2.1 Leadership

Leadership research has known over time a great evolution in the way leaders and followers have been perceived. According to Cunha and Rego (2005), leadership theories evolved based on three approaches: first, universal approaches, later contingent approaches and, more recently, value-based approaches. According to the authors, the essential difference between approaches lies in the way in which two strands intersect: the focus is on personality or behavior. For Cunha and Rego (2005: 22), "the essential difference between the two lies in the following: personality is stable and difficult to change, whereas behaviors can be learned and altered."

2.2 Transformational and transactional leadership

The term transformational leadership was used for the first time by Burns (1978), meaning "leadership by leaders who introduce changes in society and organizations, leaving indelible marks." stated Rego (1998).

According to Rego (1998), transformational leaders "inspire their followers, are able to implement great changes in the attitudes and members of organizations, and obtain from them the commitment and empathy necessary to achieve the goals."

For the author, there are four main components in this type of leadership:

1. The charismatic component: the charismatic characteristics of the transformational leader are socio-affective in nature and inspire subordinates to feelings of loyalty and devotion;
2. the inspirational component: the leader elicits the enthusiasm of the subordinates in achieving group goals;
3. Consideration by subordinates: enhances the team and promotes the organizational values of respect and trust;
4. Intellectual stimulation: the leader's effort to lead subordinates to move beyond the short term and develop their strategic capabilities.

As we have seen, the charisma assumes particular importance in transformational leaders. But do charismatic and transformational leaders have the same characteristics? Bass (Bass apud Rego, 1998) clarifies: "*Charisma is a necessary (and even the most important) ingredient of transformational leadership, but it is not enough by itself to confer transformational*

characteristics. So a charismatic leader may not be transformational (as is the case with rock stars, famous athletes), although all transformational leaders have charismatic behavior. "

In transformational leadership the motivation is above all inspirational, based on a seductive vision of the future. Transformational leaders reveal a moral stance and self-sacrifice that induces trust and admiration. Transformational leadership involves values such as honesty, responsibility, reciprocity and honor.

On the contrary, transactional leadership "motivates followers by their self-interest." (Burns apud Rego, 1998) Is it equally effective? Rego (1998) considers: *"Both types can be effective, albeit in different situations of organizational life. Transformational ones would be most geared to periods of foundation and change, while others would be more adapted to periods of slow evolution and non-turbulent environments. "*

These two types of leadership are distinct processes, although they are not mutually exclusive, so the same leader can use both types of power at different times and in different situations. Thus, while the transactional leader bets on management for continuity, focusing on rules and their application, the transformational leader bets on change management, redefining "the rules of organizational culture on the basis of in their vision of a more satisfying future." (Rego, 1998).

In the same way, the transactional leaders are meant to keep the team functioning in a routine, so the motivation of the leaders is based on a reward game for performance. On the contrary, transformational leaders are enveloped in a more inspirational, self-motivating aura.

2.3 Resonant and dissonant leadership in the performance of the followers

According to Goleman, Boyatzis and Mackee (Goleman et al., 2002), if you ask any business man "What do leaders actually do?" Their answers will tend to be: "Leaders define a strategy; they motivate; they create a mission; they build a culture." Similarly, when the question is not what leaders do, but rather what they should do, the answer is also unanimous: "The leader's key job is to achieve results." Goleman (2002) But how to do it?

According to Cunha (Cunha et al., 2010), "despite the change, there are immutable values, namely the need felt by people to carry out meaningful work, in organizational environments where respect prevails." Organizations and leaders should, first, make people, more than equipment. (Cunha et al, 2010)

Goleman (2002) consider that leadership can be processed in two ways: with resonance or with dissonance. Resonance leadership happens when the leader is attuned to the people he leads and follows a positive emotional path. On the contrary, leadership is dissonant when the leader is not in tune with the sentiment of the led and leads "along a downward spiral, from frustration to resentment, to rancor and fury."

The term "resonance" derives from the Latin word resonare, which means to resonate to echo, to increase the volume of the voice or sound. Similarly, it means "to reinforce or prolong a sound through reflection, or more specifically," through synchronized vibration. " (Goleman et al., 2002b) Thus, " the equivalent is two persons being of the same length emotional wave -

they sit in the "same wave". And, faithful to the original meaning, the synchronized vibration "resonates," that is, prolongs the positive emotional tone" stated Goleman (2002).

According to the same authors, "when a group of followers vibrates with the animation and enthusiastic energy of the leader, it is a sign that there is leadership with resonance." (Goleman et al., 2002b) resonance is a natural gift of emotionally intelligent leaders. "

On the other hand the word "dissonance" means, in its primitive musical sense, "harsh, unpleasant sounds; both in terms of music and in human terms, dissonance means lack of harmony." (Goleman et al, 2002) Thus, dissonant leadership" generates groups where emotional discord predominates, where people feel permanently de-tuned." For example, "just as laughter is a good barometer of the degree of resonance in the workplace, anger, fear, apathy or even taciturn silence are indications to the contrary." (Goleman et al., 2002b)

According to Goleman et al (2002b), "resonance does not come only from the willingness of leaders or their ability to say right things. It also comes from coordinated sets of activities that define leadership styles. "According to the authors cited," the best leaders, the most efficient, act according to one or more of six leadership styles, and change from one to the other according to the (Goleman et al., 2002b). The others - the visionary, the advisor, the relational and the democratic - generate the kind of resonance that leads to performance improvements. The pressor and the guide - "may be useful in specific situations, but must be used with care." (Goleman et al., 2002b)

For Goleman et al (2002), leaders who use leadership styles with positive emotional effects are the ones who achieve the best results. Yet, they use different styles according to needs, grading their use and passing on from one to the other. "According to the same authors," leaders who have a critical mass of six leadership skills, or (Goleman et al, 2002), and in the same way that successful leaders use "a differentiated set of leadership skills" (Goleman et al, 2002).

According to the aforementioned authors, the best results come from leaders who resort to at least four styles of leadership with resonance, using them as needed. Likewise, behind the worst results are leaders who use only one or two leadership styles, usually dissonant leadership. (Goleman et al., 2002) We will see briefly and individually each of the styles that integrate resonant leadership and dissonant leadership.

2.4 Resonant leadership styles

2.4.1 The Visionary Style

According to Goleman et al (2002), visionary leaders "tell where the group should go, but they do not explain how one gets there - they leave people free to innovate, to experiment, to take calculated risks "So," if you have a global vision and know the way it is embedded, people get clear ideas: they understand what is expected of them, "demonstrating" pride "in belonging to the organization since" they are working to goals that everyone shares."

Visionary leaders resonate because they channel people to shared visions and dreams. (See Golamen et al., 2002) Goleman et al. (2002) point out that visionary leaders gain another

advantage: "they can retain the most valuable employees." As "people vibrate with values, the company's mission, it becomes his favorite employer." (Goleman et al, 2002)

2.4.2 The style counselor

Goleman et al. (2002) state that "although it is widely held that leaders have to be good counselors, this is a style that is not widely practiced." Similarly, "in this age of great tensions and pressure to get results, leaders say they do not have the time. But by ignoring this style of leadership, they are losing a powerful tool." (Goleman et al, 2002)

Council leaders convey the idea that they are "genuinely interested in people, rather than as mere tools of work." (Goleman et al, 2002) And while their activities focus on personal development rather than (Goleman, 2002) By taking time for personal conversations, "leadership leaders build trust and good relationships." (Goleman et al. 2002) The advisory leaders "create continuous relationships that lead employees to listen openly to comments about their work, understanding those comments and observations as being conducive to their own aspirations rather than merely expressing the interests of the boss." (Goleman et al, 2002)

2.4.3 The relational style

Goleman et al. (2002) consider that relational style, "while not directly improving performance, has surprisingly positive effects on the group's relational climate, only being overtaken by the stimulating effects of the visionary style and counselor." distinctive of the relational leader is "sharing of emotions" (Goleman et al, 2002). "Leaders of this kind value people and feelings - place less emphasis on tasks and goals and more on the emotional needs of employees." Thus, "they strive to keep people happy, to create harmony, and to generate resonance in the team ... " (Goleman et al, 2002)

For the authors referred to, "by treating employees as individuals - for example, by giving them emotional support in difficult phases of personal life - relational leaders generate great bonds of loyalty and relationship." (Goleman et al., 2002) This style "is especially recommended when it is necessary to increase harmony within the group, raise morale, improve communication or restore links of trust in the organization that have broken down." (Goleman et al., 2002)

2.4.4 The democratic style

According to Goleman et al (2002), "the democratic style relies on three competences of emotional intelligence: team spirit and collaboration, conflict management and influence." The democratic leader "the person and meetings where he listens to the concerns of employees and stakeholders to raise their morale." (Goleman,2002)

Democratic leaders "convey the feeling that they really want to know the ideas and concerns of employees - and that they are willing to do so." (Goleman et al., 2002) "They are true collaborators, working in the spirit of team and not as bosses who give orders from the top." (Goleman, 2002)

By giving time for listening and participation to their followers, democratic leaders allow stakeholders to come to their inevitable conclusions, avoiding unpleasant reactions. They rely on "the feelings of trust and respect from stakeholders to gain adherence and commitment." (Goleman et al., 2002)

2.5 Dissonant leadership styles

2.5.1 The style presser

It is a style that "can be very successful, especially in technical areas, with highly specialized professionals,...) or with a very aggressive sales force." (Goleman et al, 2002) In these situations, "pressing, pacing, expecting more, can make sense, particularly in the early stages of the company's life cycle, when growth is of the utmost importance." (Goleman, 2002)

The "push leader" sets the example and presents high levels of performance. He is obsessed with the idea of doing things better and faster, and wants others to do the same. "(Goleman et al, 2002) for this reason, this leader" quickly detects employees who have poor performance, and if they do not correspond, it is the leader who intervenes to save the situation "(Goleman, 2002).

2.5.2 The "guide" style

The "guide" style, also denominated of coercive style, has as main motto «Do this because I say». (Goleman et al., 2002) Leaders of this type "demand immediate obedience to orders, but do not bother to explain the reasons. If subordinates do not obey orders without asking questions, these leaders resort to threats." (Goleman, 2002)

Instead of delegating authority, leadership leaders seek to maintain tight control over situations to address them in detail. "For this reason, either they do not give feedback to people or only refer to what they did wrong, never what they did well." (Goleman et al, 2002) For these reasons, the "guide" style "is the least effective in greater number of situations." (Goleman, 2002)

As stated by Correia (2013) The main purpose of leadership is to achieve results through people. The question is no longer "what is the leader doing?" Or "what leader should he do?" To become "how should the leader do?". Resonance leadership happens when the leader is attuned to the people he leads and follows a positive emotional path. Leadership is dissonant when the leader is not in tune with the feelings of his followers, leading them to frustration, resentment, rancor, and fury.

2.6 Organizational Culture

Organisational Culture is defined as the way in which members of an organisation relate to each other, their work and the outside world in comparison to other organisations. It can either enable or hinder an organisation's strategy. (Hofstede, 1991)

Culture has been defined in many ways; Hofstede's (2011) shorthand definition is: "Culture is the collective programming of the mind that distinguishes the members of one group or category of people from others". It is always a collective phenomenon, but it can be connected

to different collectives. Within each collective there is a variety of individuals. If characteristics of individuals are imagined as varying according to some bell curve; the variation between cultures is the shift of the bell curve when one moves from one society to the other (Hofstede, 2011).

In the 1970s this author – more or less by accident – got access to a large survey database about values and related sentiments of people in over 50 countries around the world (Hofstede, 1980). These people worked in the local subsidiaries of one large multinational corporation: IBM. Most parts of the organization had been surveyed twice over a four-year interval, and the database contained more than 100,000 questionnaires. Initial analyses of the database at the level of individual respondents proved confusing, but a breakthrough occurred when the focus was directed at correlations between mean scores of survey items at the level of countries. Patterns of correlation at the country level could be strikingly different from what was found at the individual level, and needed an entirely different interpretation. One of the weaknesses of much cross-cultural research is not recognizing the difference between analysis at the societal level and at the individual level; this amounts to confusing anthropology and psychology. (Hofstede, 2011).

As stated by Hofstede (2011) when *Culture's Consequences* appeared in 1980, it represented a new paradigm in social science research: analyzing survey-based values data at the national level and quantifying differences between national cultures by positions on these dimensions. Like other new paradigms, it initially met with rejection, criticism and ridicule next to enthusiasm (Kuhn, 1970). By the 1990s the paradigm had been taken over by many others, and discussions shifted to the content and number of dimensions. The paradigm inspired a number of other studies into dimensions of national cultures. (Hofstede, 2011)

Besides the huge research on Organizational culture developed during previous year, another large scale application was the GLOBE (Global Leadership and Organizational Behaviour Effectiveness) project, conceived by US management scholar Robert J. House in 1991. At first House focused on leadership, but soon the study branched out into other aspects of national and organizational cultures (Hofstede, 2011).

The dimensional paradigm can be applied at other than the national level as well, in particular at the organizational and occupational levels (Helmreich & Merritt, 1998).

Hofstede research developed a model that integrate 6 dimensions. That dimensions depend on the level of aggregation; it describes the six entirely different dimensions found in the Hofstede et al. (2010) research into organizational cultures.(Hofstede, 2011)

1. Hofstede's Multi-Focus Model on Organisational Culture is a strategic tool aimed at helping organisations to become more effective by ensuring you get a detailed picture of:
2. How do employees really relate to their organisational culture – ensuring a matching picture between employee branding/recruitment texts and real life work environment.
2. How ready an organisation is for change – is there enough trust, not too much anxiety and are the relevant groups ready for change?
3. How is the actual way of working (actual culture) and the desired way of working

(desired culture) aligned with the optimal culture (strategic choice on which way of working best supports the execution of a given strategy within the available resources and time).

4. How well management is able to use its behaviour to set the example (walk the talk).
5. How indirect change initiatives can assist in ensuring a better fit between the actual way of working and optimal way of working.

Based on Hofstede (2011) a brief description of the dimensions will be presented.

2.7 Info sheet The Multi-focus Model

The Dimensions of the Organisational Culture

Hofstede's Multi-Focus Model consists of six autonomous dimensions or variables. This provides insights on the fit between the actual culture and any strategic direction you can think of. Different combinations of dimensions provide insights in various strategic fits and the results generate easy to understand visualisations such as following example:

Dimension 1: Means-Oriented Vs. Goal-Oriented

This dimension is closely connected to the effectiveness of the organisation. In a means-oriented culture the key feature is the way in which work has to be carried out; people identify with the "how".

In a goal-oriented culture employees are primarily out to achieve specific internal goals or results, even if these involve substantial risks; people identify with the "what". In a highly means-oriented culture people perceive themselves as avoiding risks and making only a limited effort in their jobs, while each workday is pretty much the same. However, in a very goal-oriented culture, the employees are primarily out to achieve specific internal goals or results, even if these involve substantial risks.

Dimension 2: Internally Driven Vs. Externally Driven

In a highly internally driven culture employees perceive their task towards the outside world as a given, based on the idea that business ethics and honesty matters most and that they know best what is good for the customer and the world at large. In a very externally driven culture the only emphasis is on meeting the customer's requirements; results are most important and a pragmatic rather than an ethical attitude prevails.

Dimension 3: Easygoing Work Discipline Vs. Strict Work Discipline

This dimension refers to the amount of internal structuring, control, and discipline. A very easygoing culture reveals a fluid internal structure, a lack of predictability, and little control and discipline; there is a lot of improvisation and surprises. A very strict work discipline reveals the reverse. People are very cost-conscious, punctual and serious.

Dimension 4: Local vs. Professional

In a local company, employees identify with the boss and/or the unit in which one works. In a professional organisation, the identity of an employee is determined by his profession

and/or the content of the job. In a very local culture, employees are very short-term directed, they are internally focused and there is strong social control to be like everybody else. In a very professional culture it is the reverse.

Dimension 5: Open System vs. Closed System

This dimension relates to the accessibility of an organisation. In a very open culture newcomers are made immediately welcome, one is open both to insiders and outsiders, and it is believed that almost anyone would fit in the organisation. In a much closed organisation it is the reverse.

Dimension 6: Employee-Oriented vs. Work-Oriented

This aspect of organisational culture is most related to the management philosophy. In very employee-oriented organisations, members of staff feel that personal problems are taken into account and that the organisation takes responsibility for the welfare of its employees, even if this is at the expense of the work. In very work-oriented organisations, there is heavy pressure to perform the task even if this is at the expense of employees.

All the above mentioned and detailed info regarding the Multi-focus Model and respective dimensions were described as Hofstede (2011) study and published.

3 Design/methodology/approach

This conceptual paper, explores the concepts of Organizations Culture framed by six autonomous dimensions or variables and two semi-autonomous dimensions (Means-oriented vs. goal-oriented, internally driven vs. externally driven, easygoing work discipline vs. strict work discipline, local vs. professional, open system vs. closed system, employee-oriented vs. work-oriented, degree of acceptance of leadership style, degree of identification with your organization). The methodology used was documentary analysis, including papers from the main scientific databases: Scopus and WOS, using the keywords Organizations, Culture, Leadership, Behavior.

The methodology to use will be a Mix method and not "Action Research" as previous planned. Quantitative and qualitative methodologies will be used to study organizational cultures, methods, leadership styles and behavior from Leader but also the effect on the followers. For that propose an existing model will be used to understand the organizational cultures by the six factors, related to concepts within the field of organizational sociology and the six dimensions that were developed based on the literature. The study is to be performed from August 2018 onwards (till March 2019) using some questionnaires as found on the literature review.

For a specific sector and environment some qualitative methodologies will be applied, using several techniques to collect data. Data collecting will be through, In-depth interviews with Top and Middle management, Business leaders. Workouts will be done with expertize people to define meaningful questions that can identify as many differences among work practices as possible. As a pre-test some Ad hoc questions will be analyzed, assessed to validate whether

they are well understood and whether the answers can differentiate. As mentioned a survey using around 100 questions administered among company employees (Managers, non-managers, operational professionals per department and ad-randomly chosen) will be used as well.

4 Results or expected results

The main expected result is the development of Leaders behaviors, adapted to Organizational Culture in place, and competencies with the goal to impact follower's results in terms of engagement and commitment.

5 Originality/value

With the specially concern to fit between strategy and culture this research will also bring perceptions on organizational culture in combination with context and in using combinations of dimensions and their reflection in real work life, such as engagement and commitment, efficiency, productivity, innovation among others.

6 Ractical implications

To get a scientific approach/ validation for an application on the field that can bring together the development of Leaders behaviors, adapted to Organizational Culture in place, and competencies with the goal to impact follower's results in terms of engagement and commitment.

References

Correia, J. F. D. (2013). LIDERANÇA RESSONANTE E DISSONANTE NO DESEMPENHO DOS LIDERADOS Dissertação, 01–143.

Cunha, M. P., & Rego, A. (2005). *Liderar*. Lisboa: Publicações Dom Quixote.

Cunha, M. P., Rego, A., Cunha, R. C., Cabral-Cardoso, C., Marques, C., & Alves e Gomes, J. (2010). *Manual de Gestão de Pessoas e do Capital Humano*. (Silabo, Ed.). Lisboa: Silabo.

de Mooij, M., & Hofstede, G. (2010). The Hofstede model: applications to global branding and advertising strategy and research. *International Journal of Advertising*, 29(1), 85. <http://doi.org/10.2501/S026504870920104X>

Goleman, D., Boyatzis, R., & Mckee, A. (2002a). Primal-Leadership-Transforming the art of leadership into the science of results. *Harvard Business Review*. Retrieved from <http://wendyjocum.com.au/wp-content/uploads/2014/02/EI-article-3.1.4-Primal-Leadership-Realising-the-Power-of-EI.pdf>

Goleman, D., Boyatzis, R., & Mckee, A. (2002b). *The New Leaders. Emotional Inteligence in Organizations*. Lisbon: Gadiva.

Helmreich, R. L., & Merritt, A. C. (1998). *Culture at work in aviation and medicine: National, organizational and*

professional influences. (Aldersho, Ed.). Hants, UK: Ashgate.

Hofstede. (1991). *Cultures and Organizations*. *Cultures and Organizations*. <http://doi.org/10.1007/s11569-007-0005-8>

Hofstede, G. (2011). Dimensionalizing Cultures: The Hofstede Model in Context. *Online Readings in Psychology and Culture*, 2(1), 1–26. <http://doi.org/10.9707/2307-0919.1014>

JM Burns. (1978). *Leadership*. NY: Harper and Row Publishers.

Kuhn, T. S. (1970). *The structure of scientific revolutions*. (2nd, Ed.). Chicago, IL: University of Chicago Press.

Rego, A. (1998). *Liderança nas Organizações – teoria e prática*. Aveiro: Universidade de Aveiro.

An Analysis of Public Sector Spending on Education in Pakistan and its Impact on the Productivity and Employability of Pakistan's Human Resource

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Abstract: This paper reviews the budgetary expenditures on public sector education in Pakistan, its issues and impact on sectorial job creation as percentage of GDP. It shows that there are multiple education systems in Pakistan with different medium of instruction and gender segregation at school levels and with multiple problems and inefficiencies. In addition, there are inadequate schools for boys and girls. Budgetary expenditure on Tertiary education is 35% and on school education 65%. There are 185 Universities in the country. The share of Agriculture in GDP in 2012-2018 period declined by 2.5%, of Industry declined by 6.7%, whereas the share of services sector grew by 9.2% increasing job opportunities in the new knowledge based economy at the cost of manufacturing sector. Government should built more schools at all levels with modern facilities and infrastructures even at remotest corners of the country. There should be scientific upgradation of teachers at all levels. Textbooks should encourage research based gender sensitive, environment sensitive and productivity orientated scientific and technological knowledge with a more progressive worldview in order to create greater linkages between school system and Higher Education with emphasis on the knowledge economy of tomorrow that incorporates international labor and human rights standards.

Keywords: GDP of Pakistan, Budgetary Expenditure on Education, Literacy Rate, School Education, Tertiary Education

1 Introduction

In this global age of information technology and connectivity, Pakistan as a developing economy has tried to increase its public sector investments on school and tertiary education, thus redirecting its policy towards the job creation in the knowledge economy to become part of the fast changing global economic paradigm. However, at the same time the country's lack of quality school education has created a knowledge gap between not only the urban and the rural parts of the country, but also between the rich and the poor strata of the economy. Which means that while the upper strata of the country is fast entering the modern age of information and knowledge, a large part of the country's population, especially its children are deprived of schooling, or quality education.

Over the years, there has been a structural change in Pakistan's Gross Domestic Product (GDP). While the share of services sector to GDP of Pakistan has been steadily increasing the Industrial as well as the Agricultural sectors of the country has been steadily declining and therefore the manufacturing sectors contribution to the GDP is only 41% and services sector contributes is 59%. Between 2012-2013 & 2017-2018 The share of Services Sector to Pakistan's GDP has grown from 58.3% to 67.5 %; the share of Industry declined from 20.3% to 13.6% and the share of Agriculture declined from 21.4% to 18.9%. The literacy rate in the country is 60% leaving 40% of the population illiterate. (Ministry of Finance, 2018)

1.1 Purpose of the Study

The purpose of the study is to analysis the budgetary allocations of Federal and Provincial Governments of Pakistan in school and tertiary education.

1.2 Design/Methodology/Approach of the Study

It is a secondary study using quantative data from the official budgetary documents of respective Governments of Pakistan to analysis the education sector and the growth opportunities in industry and services sectors of the country

1.3 Problem statement

Pakistan is sixth largest by population in the world with almost 60 percent of the population categorized as youth. At the same time, 40 percent of the population is illiterate. Half of the school going children are out of school and another 50 % drop out before reaching class five and a majority of these are girls. On the upper spectrum, there are 185 universities and professional institutes in the country-producing professionals in different disciplines (Ministry of Finance, 2018). The present paper will look into the relationship between budgetary spending and impact of education on the economy of Pakistan from 2013 until 2018.

1.4 Objectives of the Study are

- 1 To analysis the impact of Public Sector investments (Budgetary Expenditures) on School Education in Pakistan
- 2 To analysis the impact of Public Sector investments (Budgetary Expenditures) on Tertiary Education in Pakistan
- 3 To analysis the impact of education on industrial sector and Services sectoral growth in the country and the job Market of Pakistan

1.5 Theoretical Base of the study

The theoretical base of the study is the **Public Choice theory of Budgets** and its implications for Education in Less Developed Countries (Gallagher, 1993) States that "when governments cut budgets they tend to allocate in a socially inefficient way".

1.6 Expected Results

H1 = Public Sector Budgetary spending and policy measures are not giving the desired results in the school education in Pakistan

H2 = Public Sector Budgetary spending and policy measures have significant impact on University and Professional education in Pakistan

H3 = School and University Education has significant impact on Industrial and Service sector growth in Pakistan

1.7 Originality/Value of the Study

The paper will have an original value that it would contribute to the general body of knowledge in assessing the trends of investments on human resource in a developing country like Pakistan. It should pin point the issues where the budgetary allocations have misfired and give a theoretical direction to policy makers as well as donors around the world of solving such issues in the near future

1.8 Practical Implications of the Study

The practical importance would be for the policy makers in Pakistan at both Federal as well as Provincial levels, and the educationists in less developed world, the private sector employers and foreign investors as well as for the future researchers.

2 Literature Review

(Ashraf & Ismat, 2016) Write, that the constitution of Pakistan provides free and universal education for all, but in reality the enrollment rate and literacy rate has remained below 60% because the government and other stakeholders in education sector could not perform well enough (Ashraf M. A., 2018). Writes that the religious education (*Madrassa* system) and modern education systems (public and private schools) in Pakistan are not compatible because these systems use different types of curriculum creating multiple socio-economic and political problems for students of different strata of Pakistan. (Memon, Spring 2013) Writes, "The participation rate at higher education is low comparatively to other countries of the region. There are problems of quality of staff, students, library and laboratory." (Hussain, 2015) Pinpoints seven major problems in the education system of Pakistan. (i) Lack of proper planning for future needs of the economy and society. (ii) Social constraints towards education. (iii) Gender gap between educating boys and girls, (iv) High cost of education, especially for the poorer strata. (v) War on terror where terrorists and extremists blown schools effected areas, (vi) Lack of funds for education and (vii) lack of technical education in the educational system of the country. (Rasheed & Mukhtar, 2012) Point out that "The natural calamities, political turbulence, provincialisms, and political motivations make the best planned, fail. The allocations towards the sector of education could not be enhanced because of the earlier. We have to revisit our priorities to keep the country on the track of progress"

(UN News, 2007) writes that the UNESCO report shows that “the United States (USA) spends 28 per cent of the global education budget although only 4 per cent of the world’s children and young people live there” Therefore the US is in fact the single largest investor in education”. (UNESCO, 2017) Stressed that “Governments should fulfil their commitment of spending at least 4% of GDP on education or allocating 15% of total government expenditure”.(UNESCO, 2018) Member states on 14th November 2017 adapted the recommendations of its education commission (See <https://en.unesco.org/news/education-commission-meets-unesco-general-conference>) and the member states endorsed the implementation of SDG4 Education 2030 (see <https://en.unesco.org/education2030-sdg4>) and budgets for implementation of Sustainable Development Goals (see <https://en.unesco.org/education2030-sdg4/targets>). Especially target 4.7 that states “By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development.”

3 Issues of Education in Pakistan

Almost 70% of the educational institutions in Pakistan are in the Public sector and 305 are in the private sector (Hussain, 2015). Major issues in the Education System of Pakistan are:

3.1 Multiple System of Education

There are multiple education systems in the country. (i) The state of the art public or highly expensive ‘elitist’ private schools where modern, holistic education is dispensed usually in Cambridge system of examinations (**A or O levels**), enabling these boys and girls to become part of the international mainstream success stories. (ii) The government schools and private schools with relatively less fee structures give irrelevant, outmoded and unscientific education in government sponsored **Metric and Intermediate** (FA / FSc) system of examination. (iii) **Madrassas** (Mosque-based Religious Schools), which are further divided into sectarian lines. Most of these madrassas do not impart any kind of job or vocational oriented education, nor do they follow any general syllabus of general education, rather they concentrate on their each version of sectarian religious teaching and learning the Quran by heart. The environment in most of them is harsh and child-unfriendly. (iv) The Public Sector **Vocational and Training Institutes** that also give segregated education for boys and girls. Most of the vocational training for girls is oriented towards ‘house’ confinement, because they teach these girls cooking, sewing and embroidery that do not create many opportunities for the girls to earn an active income away from home in the agricultural, industrial or services sectors.

3.2 Gender Separation in Education

Important issue in education system of Pakistan is the gender segregation of schools and colleges for male and female students. There is no specific policy about schools for transgender children because until recently they were not issued National Identity Cards

(CINC) without which one cannot get admission or a job or own property and business in the country. The first school for transgender children has opened in Lahore in 2018 by an NGO.

3.3 The Language Debate in Education (Medium of Instruction)

An important issue in Pakistani education system are – the language issue – where medium of instructions in the ‘elitist’ schools, colleges and at University levels is in English language with Urdu (the national language of Pakistan) as a subject. While in government schools and colleges in the Punjab, the medium of instruction is Urdu with English as one of the subjects and in the rest of the provinces, the medium of instruction is in regional languages with Urdu and English as subjects. There is practically no research base in Urdu (or the regional languages) nor are there any significant translations of world knowledge in these languages.

3.4 Substandard Textbooks

Most of the Public Sector schools as well as the private schools for the poorer strata of the country lack a vision of what education is all about. There is a ‘textbook racket’ in the country that provide substandard books to students. The level of textbooks published for schools, (especially in Urdu language) are of poor quality, have gender biases and lack the basic scientific direction needed for modern day industrial and technical base of a rapidly developing society. These textbooks do not teach productive habits, nor analytical skills, not any basic form of citizenship behaviors needed for entering the 21st century’s knowledge economy.

3.5 Lack of Teacher Training in School system of Pakistan

There are few facilities for teacher training in Pakistan. Although Public sector provides regular teacher training, this training lacks vision, scientific teaching methodology and human touch that modern teachers should have. There is a system of ‘root learning’ and scientific or modern methods of analytic thinking and learning are usually missing among both teachers and students. Private schools get good teachers through trial and error. Salaries of schoolteachers in Pakistan are less than that of cooks and drivers in urban centers of the country, therefore many of the teachers lack motivation and compassion towards their students.

3.6 Administrative lack of good governance in Education system

As there is no uniform regulatory body for the school system in the country like the Higher Education Commission (HEC) that governs the Universities and professional institutions. Education Departments in each province govern the Schools system. There are massive issues of bad governance, corruption mismanagement and nepotism in the education Departments, Text Book Boards, school inspectors, as well as the head masters of the schools. For each Euro spent on the school education system of the country, the teacher and the student only get just 20% of the money intended for them.

4 Economy of Pakistan

According to the census figures of 2017, total population of Pakistan is 207.8 million people, out of which - 106.45 million (51.23%) are males, 101.32 million (48.76%) are females, and 10.4 thousands (0.01%) are transgender. Out of the total population - 132.2 million (63.6%) People live in rural areas and 75.6 million (36.4%) people live in urban areas (Ministry of Finance, 2018). Provinces wise the breakup of the population of Pakistan is as follows – Punjab 110.0 million (53%). Sindh 48.0 million (23%). Khyber Pakhtunkhwa (KPK) 30.5 million & Federally Administered Tribal Areas (FATA) 5 million = 35.5 million (17%). Baluchistan 12.3 million (6%) and Islamabad 2 million (1.4%) (Ministry of Finance, 2018) Of total population of Pakistan in 2015-2016, 58% (120.6 million) were literate (of them, 70% males and 48% females) leaving 42% (87.4 million) of the population as illiterate (of them 30% males & 52% females). (Ministry of Finance, 2018)

Table 1 and Figure 1 (Ministry of Finance, 2018) shows the Growth rate of Pakistan's Agricultural Sector, Industrial Sector, Services Sector and Total GDP in Percentages 2012-2018. The table shows that from 2012-2013 to 2017-2018 the growth rate of Pakistan's Agriculture increased from 2.68% to 3.81% (an average growth rate of **2.22%**). The growth rate of Industrial sector rose from 4.53% to 5.8% (an average growth rate of **4.56%**) and the growth rate of Services sector rose from 4.46% to 6.43% (an average growth rate of **5.42%**). Total GDP of the country grew from 3.68 to 5.79 in the same period (an average growth rate of **4.59%**).

Table 1 Pakistan's GDP Growth Rates in Percentages 2012-2018

Years	Agriculture	Industry	Services	GDP
2012-2013	2.68%	0.75%	5.13%	3.68%
2013-2014	2.50%	4.53%	4.46%	4.05%
2014-2015	2.13%	5.18%	4.36%	4.06%
2015-2016	0.15%	5.69%	5.72%	4.56%
2016-2017	2.07%	5.43%	6.46%	5.37%
2017-2018	3.81%	5.8%	6.43%	5.79%
Average Growth	2.22%	4.56%	5.42%	4.59%

Source: (Ministry of Finance, 2018)

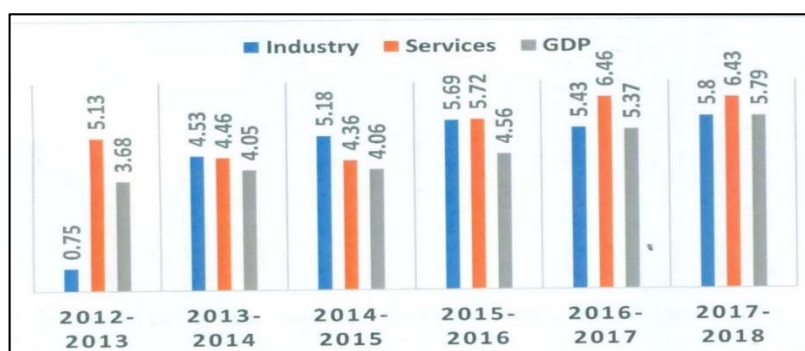


Figure 1 Growth Rate of Pakistan's Industrial Sector, Services Sector and Total GDP in Percentages 2012-2018

In 2017-2018, there are 268 thousand mainstream educational institutions in Pakistan with a total enrolment of 50.4 million students (24.2 % of total population of Pakistan) and 1.8 million teachers. The breakup of these institutions, enrolment and teachers is – 174 thousand Primary schools (until class 2nd) with total enrolment of 22.5 million and 496 thousand teachers. 51.4 thousand Middle schools (classes 3rd, 4th & 5th) with total enrolment of 7.2 million and 493 thousand teachers. 32 thousand High schools (classes 6th, 7th & 8th) with total enrolment of 3.8 million and 583 thousand teachers. 5 thousand High Secondary Schools and Intermediate /Colleges (classes of 9th & 10th /11th & 12th) with total enrolment of 1.75 million and 119 thousand teachers. 1.6 thousand Degree Colleges (until 14 years education) 1.1 million enrolment and 43.6 thousand teachers. 4.0 thousand Vocational Institutions with 358 thousand enrolment and 19 thousand teachers. There are 185 Public Sector and Private Sector Universities and professional institutions (from 16 years and above until PhD level education) in Pakistan with a total enrolment of 1.4 million (0.7% of total population of Pakistan) and 54 thousand teachers & professor of different grades and pay scales. (Ministry of Finance, 2018)

Net provincial wise enrolment rate (NER) in Pakistan in 2015-2016 was – In Punjab 59% (60% males & 58% females). In Sindh 48% (52% males & 44% females). In KPK 53% (58% Males & 47% Females). In Baluchistan 33% (38% Males & 26% Females). A Net 54% for Pakistan (56% Males & 51% Females) (Ministry of Finance, 2018).

5 Budgetary Issues of Educational System

Pakistan being a Federation distributes its budgetary spending in the federal well as four provincial budgets (The Provinces of Punjab, Sindh, Khyber Pakhtunkhwa or KPK and Baluchistan). After the 18th Constitutional amendments the allocations on education are provincial subjects, therefore it is pertinent to calculate the budgetary expenditures of all four provinces as well as the federal allocations on education to get a better picture of the government's expenditures on education.

Table 2 Province wise Expenditure on Education in Pakistan 2013-2018 in Billion Euros

In Billion Euros	Federal	Punjab	Sindh	KPK	Baluchistan	Total	As percentage of GDP
2013-2014	0.62	0.4	0.89	0.64	0.23	2.78	2.1%
2014-2015	0.61	0.38	1.18	0.75	0.29	3.21	2.2%
2015-2016	0.7	0.44	1.09	0.32	0.31	2.86	2.3%
2016-2017	0.8	0.66	1.18	0.22	0.36	3.22	2.2%
2017-2018	0.93	0.74	1.4	0.27	0.39	3.73	2.2%

Source: (Ministry of Finance, 2018) (Government of Pakistan, 2017-2018; 2015-2016) (Government of Punjab, Pakistan, 2017-2018; 2015-2016) (Government of Sindh, Pakistan, 2017-2018; 2015-2016) (Government of KPK, Pakistan, 2017-2018; 2015-2016) (Government of Baluchistan, Pakistan, 2017-2018; 2015-2016)

Table 2 and Figure 2 (derived from table 2) shows the province wise expenditure on education in Pakistan from 2013 until 2018 (all Tables) calculated at Exchange Rate **Pakistan Rupee (PRS) 142.5 = 1 (€) Euro** (Hamari Web, 2018). Total expenditure on Education in the country in 2013-

2014 was - € 2.78 billion. In 2014-2015 € 3.21 billion. In 2015-2016 € 2.86 billion. In 2016-2017 was € 3.22 billion, and in 2017-2018 € 3.73 billion. Although the budgetary outlay in money terms are increasing every year, but in percentage terms this expenditure on education remains relevantly constant and comes to an average of 2.2 per cent of Pakistan’s annual GDP.



Figure 2 Province wise Expenditure on Education in Pakistan 2013-2018 in Billion Euros

Table 3 and Figure 3 shows that Pakistan spent Education (Current & Development) Euros 2.78 billion in 2013-2014; Euros 3.21 billion in 2014-2015; Euros 2.86 Billion in 2015-2016; Euros 3.22 billion in 2016-2017 and Euros 3.73 billion in 2017-2018. An average of Euros 3.16 billion yearly over these five years – the lowest in 2013-2014 and the highest in 2017-2018.

Table 3 Total Budgetary Expenditure (Federal & provincial) on Education in Pakistan 2013-2018

Years	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
In Billion Euros.	2.78	3.21	2.86	3.22	3.73

Source: (Ministry of Finance, 2018) (Government of Pakistan, 2017-2018; 2015-2016) (Government of Punjab, Pakistan, 2017-2018; 2015-2016) (Government of Sindh, Pakistan, 2017-2018; 2015-2016) (Government of KPK, Pakistan, 2017-2018; 2015-2016) (Government of Baluchistan, Pakistan, 2017-2018; 2015-2016) .

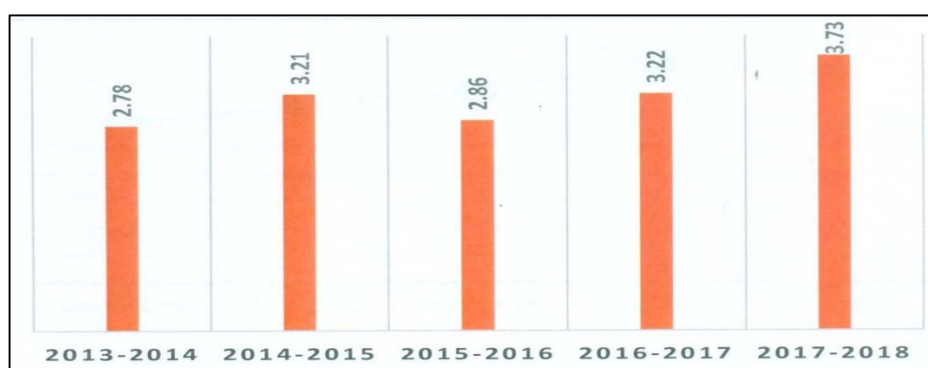


Figure 3 Total Budgetary Expenditure (Federal & provincial) on Education in Pakistan 2013-2018 in Billion Euros

5.1 To analysis the impact of Public Sector investments on School & Primary Education in Pakistan

Table 4 and Figure 4 (derived from table 4) shows that the Pakistan's total (Federal & Provincial expenditure (Current & Development) on School (Primary & secondary) Education 2013-2018 were in 2013-2014 Euro 1.45 billion (41% of the entire budgetary allocations on education in the country). In 2014-2015 was Euro 1.65 billion (44%), came down to Euro 1.22 billion (37.4%) in 2015-2016 and increased to Euro 1.3 billion (35.7%) in 2016-2017. In 2017-2018, it was Euro 2.36 billion (55% of the entire budgetary allocations on education in the country).

Table 4 Pakistan's total (Federal & Provincial expenditure (Current & Development) n School (Primary & secondary) Education 2013-2018

Years	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
In Billion Euros.	1.45	1.65	1.22	1.3	2.36

Source: (Ministry of Finance, 2018) (Government of Pakistan, 2017-2018; 2015-2016) (Government of Punjab, Pakistan, 2017-2018; 2015-2016) (Government of Sindh, Pakistan, 2017-2018; 2015-2016) (Government of KPK, Pakistan, 2017-2018; 2015-2016) (Government of Baluchistan, Pakistan, 2017-2018; 2015-2016) .

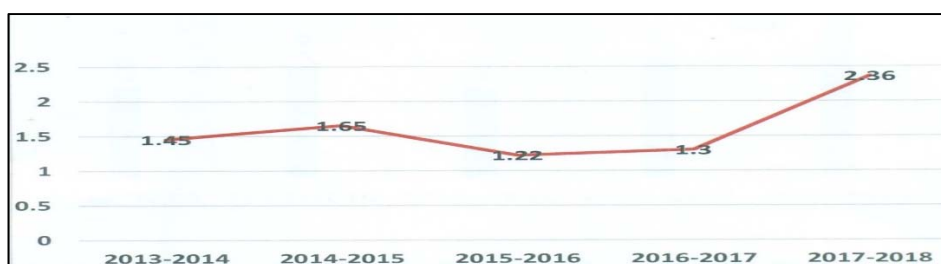


Figure 4 Pakistan's total (Federal & Provincial expenditure (Current & Development) on School (Primary & secondary) Education 2013-2018 in Billion Euros

In 2013-2014, there were 159.7 Thousand Primary schools in Pakistan (60.3 thousand for girls and 99.4 thousand for boys). While there were 42.9 thousand middle schools (21.1 thousand for girls and 21.8 thousand for boys) and 30.6 thousand high schools (12.6 thousand for girls and 18 thousand for boys) in Pakistan. In 2017-2018 primary schools increased to 173.7 thousand (58.7 thousand for girls and 115 for boys) – a decrease of 6.6 thousand schools for girls and an increase of 15.6 thousand primary schools for boys. Middle schools increased to 51.4 thousand (31 thousand for girls and 20.4 thousand for boys) – an increase of girls school by almost 10 thousand and a decrease of boys schools by 1.4 thousand. High schools increased to 31.9 thousand (15.5 thousand for girls and 16.4 thousand for boys) in 2017-2018 – an increase of girls schools by almost 4 thousand and a decrease of boys schools by 1.6 thousand schools (Ministry of Finance, Government of Pakistan, 2017-2018).

Enrolment in Primary, Middle and High schools in Pakistan 2013-2018

In 2013-2014, there were 19.44 million students enrolled in the primary classes (I to V) out of which 8.6 million were girls and 10.84 million were boys. In 2017-2018 the enrolment in Primary classes went up to 22.5 million (10.1 million were girls and 12.4 million were boys). An increase of 1.5 million girls and 1.56 million boys enrolled in the primary classes all over Pakistan during 2013-2018 period.

In 2013-2014, there were 6.5 million students enrolled in secondary classes (VI-VIII) out of which 2.8 million were girls and 3.7 million were boys. In 2017-2018, the enrolment 7.2 million students enrolled in secondary classes, out of which 3.2 million were girls and 4.0 million were boys. An increase of 0.4 million girls and 0.3 million boys enrollment in middle schools between 2013-2018 period.

In 2013-2014, there were 4.3 million students enrolled in High schools (IX-XII) out of which 1.8 million were females and 2.5 million were males. In 2017-2018, there were 5.5 million students enrolled in High schools (IX-XII) out of which 2.3 million were females and 3.2 million were males. An increase of 0.5 million females and 0.7 million males enrollment in high schools over these five years period (Ministry of Finance, Government of Pakistan, 2017-2018).

5.2 To analysis the impact of Public Sector investments on Higher & University Education in Pakistan

Table 5 and Figure 5 (derived from table 5) shows that the total expenditure on Higher Education – Colleges, Universities & Professional (Tertiary) in 2013-2014 was Euros 1.16 billion (33.0% of total spending on education in the country). In 2014-2015 was Euros 1.3 billion (35.0%). In 2015-2016 was Euros 1.4 billion (43.0%). In 2016-2017 was Euros 1.6 billion (44.0%). In addition, in 2017-2018 is Euros 1.5 billion (35.0% of total spending on education in the country). An average spending of Euros 1.4 billion per year in the last 5 years, when industrial sector grew from 4.5% to 5.8% and services sector grew from 4.46% to 6.43% in the same 5-year period.

Table 5 The Pakistan’s total (Federal & Provincial expenditure (Current & Development) on Higher (Tertiary) Education 2013-2018

Years	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
In Billion Euros	1.16	1.3	1.4	1.6	1.5

Source: (Ministry of Finance, 2018) (Government of Pakistan, 2017-2018; 2015-2016) (Government of Punjab, Pakistan, 2017-2018; 2015-2016) (Government of Sindh, Pakistan, 2017-2018; 2015-2016) (Government of KPK, Pakistan, 2017-2018; 2015-2016) (Government of Baluchistan, Pakistan, 2017-2018; 2015-2016) .



Figure 5 Pakistan’s total (Federal & Provincial expenditure (Current & Development) on Higher (Tertiary) Education 2013-2018 in Billion Euros

It should be noted that the number of Higher Educational Institutions in Pakistan in 2013-2014 were 161 Universities and 1,086 Degree Colleges (518 for females & 568 for males). In 2014-2015, there were 163 Universities and 1,410-Degree Colleges (308 for females & 1102 for males). In 2015-2016, there were 163 Universities and 1,418-Degree Colleges (260 for females & 1158 for males). In 2016-2017, there were 185 Universities and 1,431-Degree Colleges (344

for females & 1087 for males). In 2017-2018, there are 185 Universities and 1583-Degree Colleges in Pakistan (305 for females & 1278 for males). The above data shows that although Public and Private Universities in the country increased from 161 to 185 during these five years (Ministry of Finance, Government of Pakistan, 2017-2018).

Also, note that the female degree colleges are constantly decreasing from 518 in 2013-2014 to 305 in 2017-2018. While the male degree colleges in the country increased from 1102 in 2013-2014 to 1217 in 2017-2018 showing that, the focus on Degree level (up to 14 years) education is on males of the country rather than the females of the same level and age.

In 2013-2014 there were 674.4 thousand students enrolled in Degree Colleges (XIII- XIV years of education) throughout Pakistan, out of which 327.0 thousand were females and 347.4 thousand were males. In 2017-2018 enrolment to degree colleges increased to 1,090.0 thousand students, out of which 68.0 thousand were females and 1,022.0 thousand were males – the enrolment of females in degree colleges decreased with 259 thousand while the enrolment of male students in degree colleges of Pakistan increased with 674.6 thousand between 2013-2018 period.

In 2013-2014 there were 1,600 thousand students enrolled in 161 Universities of Pakistan out of which 805 thousand were females and 795 thousand were males. In 2017-2018 there were 1423 thousand students were enrolled in 185 Universities of the country, out of which 630 thousand were females and 793 thousand were males. Although from 2013-2014 to 2017-2018, the number of universities in the country increased from 161 to 185, the number of students enrolled at different levels in these universities and professional institutions decreased by 165 thousand females and 2 thousand males (Ministry of Finance, Government of Pakistan, 2017-2018).

5.3 The Impact of Education on Industrial Sector and Services Sectoral Growth in the Country and the Job Market of Pakistan

As seen from tables 1 and 3, in 2013-2014 with budgetary spending of Euros 2.78 billion on education, the industrial sector grew by 4.5% and services sector grew by 4.46%. In 2014-2015 with budgetary spending of Euros 3.21 billion on education, the industrial sector grew by 5.18% and services sector grew by 4.36%. In 2015-2016 with budgetary spending of Euros 2.86 billion on education, the industrial sector grew by 5.7% and services sector grew by 5.72%. In 2016-2017 with budgetary spending of Euros 3.22 billion on education, the industrial sector grew by 5.43% and services sector grew by 6.46%. In addition, in 2017-2018 with budgetary spending of Euros 3.73 billion on education, the industrial sector grew by 5.8% and services sector grew by 6.43%.

5.4 Development Budget & Allocation on Education 2013-2018

Table 6 and Figure 6 (derived from table 6) shows that Pakistan's Development Expenditure on Education in 2013-2014 was Euro 0.54 billion (15.25% of entire budgetary allocation for education in Pakistan (Federal & Provincial). In 2014-2015 was Euro 0.67 billion (18.0%). In 2015-2016 was Euro 0.54 billion (16.6%). In 2016-2017 was 0.73 billion (20.0%) and in 2017-

2018 is Euro 1.04 billion (24.2% of entire budgetary allocation for education in Pakistan (Federal & Provincial)).

Table 6 Pakistan’s Development Expenditure on Education 2013-2018 in Billion Euros

Years	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
In Billion Euros.	0.54	0.67	0.54	0.73	1.01

Source: (Ministry of Finance, 2018) (Government of Pakistan, 2017-2018; 2015-2016) (Government of Punjab, Pakistan, 2017-2018; 2015-2016) (Government of Sindh, Pakistan, 2017-2018; 2015-2016) (Government of KPK, Pakistan, 2017-2018; 2015-2016) (Government of Baluchistan, Pakistan, 2017-2018; 2015-2016) .

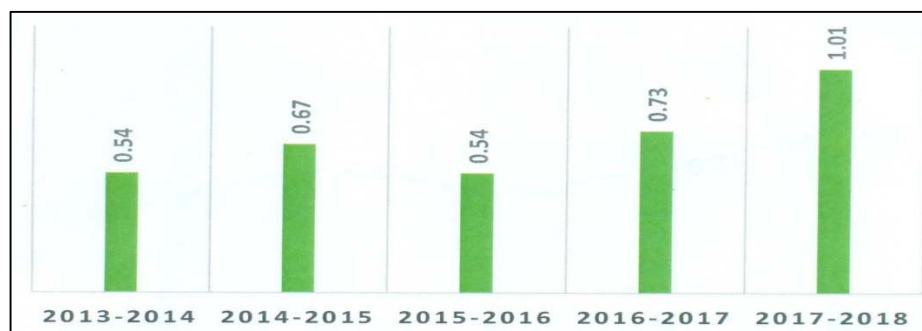


Figure 6 Pakistan's Development Expenditure on Education 2013-2018 in Billion Euros

It is also true that whenever there are financial cuts on the budgets in federal and provincial budgets of Pakistan, the axe falls on development budgets and over the years education and health departments are usually hit the hardest when budgetary allocations are reduced which are clearly seen from the revised budget estimates in subsequent years.

6 Conclusion

There are multiple education systems, teaching methods and examination systems prevailing in the country from A or O levels in elite private schools, to Metric and Intermediate levels in public sector for general public to Mosque-based Religious Schools (*Madrasas*) for the very poor as well as Vocational and Training Institutions. Medium of instructions in the ‘elitist’ schools, colleges and at University levels is in English while for Public sector schools is the national or regional languages with practically no research base or any significant translations of world knowledge in Urdu or the regional languages. There are few facilities for teacher training. Most of Public schools in Pakistan lack scientific teaching methodology and compassion. There are also massive issues of bad governance, corruption mismanagement and nepotism in the education Departments, Text Book Boards etc. There is a ‘textbook racket’ in the country that provide substandard books to students. Most of the youth coming out of public sector and *Madrasa* based institutions are not employable due to lack of jobs or due to lack of proper productive (motor or analytical) skills needed for the jobs and due to structural changes in the economy and the world towards more scientific and technological based production and innovation. The literacy rate in Pakistan is 60% of the population leaving 40% of the adult population illiterate.

In 2013-2018 period in Pakistan, the Primary schools for girls decreased by 6,600 while for boys increased by 15,600. Middle schools for girls increased by 10,000 while for boys decreased by 1,400. High schools for girls increased by 4,000 while for boys decreased by 1,600. In the same period, Primary School enrolment for girls increased by 1.5 million and for boys by 1.56 million. Middle school enrolment for girls increased by 0.4 million and for boys increased by 0.3 million. High school enrolment increased for females by 0.5 million and for males by 0.7 million. Degree colleges increased from 1.4 thousand to 1.58 thousand. However, the Degree colleges for females decreased from 518 to 305 while for males increased from 568 to 1,278. The enrolment of females in degree colleges decreased with 259 thousand while the enrolment of male students in degree colleges of Pakistan increased with 674.6 thousand. In the same period, Expenditure on Tertiary education increased from € 1.16 billion to 1.5 billion, an average of 35% of the Country's budgets on education. Universities in the country increased from 161 to 185. The number of students enrolled at different levels in these universities and professional institutions decreased by 165 thousand females and 2 thousand males. There is gender segregation of schools and colleges for male and female students. While Universities & professional institutions have co-education and in many there is state of the art research and teaching facilities.

Although the budgetary outlay in money terms are increasing every year, but in percentage terms, this expenditure on education comes to an average of 2.2 per cent of Pakistan's GDP. With budgetary allocation for education of € 2.78 billion in 2013-2014 increased to € 3.73 billion in 2017-2018, the industrial sector increased from 4.5% to 5.8% and services sector increased from 4.46% to 6.43% in the same period creating additional job opportunities in these sectors of the country. The structural transformation in Pakistan's economy during 2013-2018 period shows that the share of Agriculture in its GDP declined by 0.5%; the share of Industry declined by 0.4%; whereas the share of services sector grew by 0.9%, reducing job demand in manufacturing sector while increasing job opportunities in the new knowledge based economy.

7 Recommendations

Education system of education in Pakistan (Public and Private) should be restructured on modern scientific (teaching and learning) basis for a more researched based, skill based, productivity based system that incorporates international labor and human rights standards catering for all strata and sections of the society uniformly and on equal basis without any gender or economic bias or discrimination. There should be one regulatory body for school education on lines of HEC. In order to save pilferages and costs and reduction of unnecessary administrative structures and duplication.

Budgetary allocations should built more schools at all levels with modern facilities and infrastructures even at remotest corners of the country and should concentrate on scientific upgradation of teachers at all levels. Textbooks should encourage research based gender sensitive, environment sensitive and productivity orientated scientific and technological knowledge with a more progressive worldview. Reduction of unnecessary and outdated

subjects from the curriculum is need of the day for greater emphasis on the knowledge economy to tomorrow as well as to create greater linkages between the school system and the Higher Education (University and Professional) system.

References

- Ashraf, M. A. (2018, January). Islamized ideologies in the Pakistani education system: The need for religious literacy. *Journal of Religious Education Volume 113, 2018 - Issue 1*, 3-13. Retrieved from researchgate.net: https://www.researchgate.net/publication/312383253_Education_and_Development_of_Pakistan_A_Study_of_Current_Situation_of_Education_and_Literacy_in_Pakistan
- Ashraf, M. A., & Ismat, H. I. (2016, November). Education and Development of Pakistan: A Study of Current Situation of Education and Literacy in Pakistan. *US-China Education Review B, November 2016, Vol. 6, No. 11*, 647-654. Retrieved from researchgate.net: https://www.researchgate.net/publication/312383253_Education_and_Development_of_Pakistan_A_Study_of_Current_Situation_of_Education_and_Literacy_in_Pakistan
- Gallagher, M. (1993). *A Public Choice Theory of Budgets: Implications for Education in Less Developed Countries*. Retrieved from *Comparative Education Review* Vol. 37, No. 2 (May, 1993), pp. 90-106: https://www.jstor.org/stable/1188679?seq=1#page_scan_tab_contents
- Government of Baluchistan, Pakistan. (2017-2018; 2015-2016). *Provincial Budget (Current & Development Expenditures) of Baluchistan*. Quetta: Ministry of Finance, Government of Baluchistan.
- Government of KPK, Pakistan. (2017-2018; 2015-2016). *Provincial Budget (Current & Development Expenditures) of Khyber Pakhtunkhwa*. Peshawar: Ministry of Finance, Government of KPK.
- Government of Pakistan. (2017-2018; 2015-2016). *Federal Budget (Current & development Expenditures) Government of Pakistan*. Islamabad: Ministry of Finance, Government of Pakistan.
- Government of Pakistan. (2018). *Economic Survey of Pakistan 2017-2018*. Islamabad: Ministry of Finance. Retrieved from Ministry of Finance: file:///D:/economic%20survey%202017-2018/Economic_Survey_2017_18.pdf
- Government of Punjab, Pakistan. (2017-2018; 2015-2016). *Provincial Budget (Current & Development Expenditures) of Government of the Punjab*. Ministry of Finance. Lahore: Government of The Punjab.
- Government of Sindh, Pakistan. (2017-2018; 2015-2016). *Provincial Budget (Current & Development Expenditures) of Government of Sindh*. Karachi: Ministry of Finance, Government of Sindh, Pakistan.
- Hamari Web. (2018, 4 30). *OPEN MARKET CURRENCY RATES IN PAKISTAN*. Retrieved from Hamariweb.com: http://hamariweb.com/finance/forex/open_market_rates.aspx
- Hussain, A. (2015, March 2). *Education System of Pakistan: Issues, Problems and solutions*. Retrieved from Islamabad Policy Research Institute: <http://www.ipripak.org/education-system-of-pakistan-issues-problems-and-solutions/>
- Investopedia. (2017). *Knowledge Economy*. Retrieved from Investopedia: <http://www.investopedia.com/terms/k/knowledge-economy.asp>
- Memon, G. R. (Spring 2013, January). Education in Pakistan: The Key Issues, Problems and The New Challenges. *Journal of Management and Social Sciences. Vol 3. No. 1*, 47-55. Retrieved from researchgate.net: <http://ibt.edu.pk/qec/jbs/3.1/5.%20Education%20in%20Pakistan-The%20Key%20Issues,%20Problems%20and%20The%20New%20Challenges.pdf>

Ministry of Finance. (2018). *Economic Survey of Pakistan 2017-2018*. Islamabad: Government of Pakistan, Ministry of Finance. Retrieved from file:///D:/economic%20survey%202017-2018/Economic_Survey_2017_18.pdf

Ministry of Finance, Government of Pakistan. (2017-2018). *Statistics of Education Sector of Pakistan*. Retrieved from Economic Survey of Pakistan: file:///D:/economic%20survey%202017-2018/statistical%20appendix/SUR-10.pdf

Powell, W. W., & Snellman, K. (2004). *THE KNOWLEDGE ECONOMY*. Retrieved from Harvard Annual Reviews: http://scholar.harvard.edu/files/kaisa/files/powell_snellman.pdf

Punjab Ministry of Finance. (2016). *Punjab Annual Budgetary Statement 2016-2017*. Lahore: Government of The Punjab.

Rasheed, D. k., & Mukhtar, S. (2012). Education in Pakistan: Problems and their Solutions. *International Journal of Academic Research in Business and Social Sciences November 2012, Vol. 2, No. 11*, 1-12. Retrieved from <http://www.hrmars.com/admin/pics/1323.pdf>

UN News. (2007, October 11). *Global education spending concentrated in few countries – UNESCO report*. Retrieved from United Nations: <https://news.un.org/en/story/2007/10/235672-global-education-spending-concentrated-few-countries-unesco-report>

UNESCO. (2017). *Accountability in education: meeting our commitments; Global education monitoring report Summery*. Retrieved from Accountability in education: Meeting our commitments: <http://unesdoc.unesco.org/images/0025/002595/259593e.pdf>

UNESCO. (2018). *Learning to live together sustainably (SDG4.7): Trends and Progress*. Retrieved from WWW.UNESCO.ORG: <https://en.unesco.org/themes/gced/sdg47progress>

Supply Chain Management and Logistics

Gaby Neumann

As in companies and the society in general, knowledge has been widely recognized and accepted as strategic resource in logistics and supply chain management. Despite of this common understanding, knowledge management has not yet been implemented in this area in large scale. The biggest challenge for properly handling this strategic resource by applying knowledge management methods and tools consists in providing the right knowledge of the right quality and with the right costs at the right place and time. Against this background the stream provides a platform for discussing specific needs for KM in logistics and specific problems in implementing KM in a logistics/supply chain context. This exchange covers a variety of facets: Individual KM and KM to support experience-based learning, the role of KM in logistics systems and supply chains of the future, and logistics and supply chain KM in cases.

Knowledge Management 4.0 – Implications of the fourth industrial revolution on knowledge management in supply chains

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Abstract: Industry 4.0 is a favourite topic of discussion from many perspectives. However, its implications on knowledge management are not in focus yet. From the perspective of Information Technology (IT) digitization in production, logistics and supply chains is expected to strongly support knowledge management because of the somehow natural link to accessing and (re-)using knowledge. On the other hand, Industry 4.0 and digitization goes inline with dramatic changes in the labour world, in the future role of human workers, in requirements for qualification and training, in the design and organization of collaboration. Here, knowledge management might become a key driver for assuring a company's sustainability. To what extent knowledge management needs to be adapted to digitization or can directly benefit from it, this needs to be subject to further investigation and discussion. Based on a review on Industry 4.0 triggers and the current state of implementation of knowledge management in logistics and supply chain management, the paper draws the link between main concepts of Industry 4.0 and knowledge management, analyses challenges knowledge management faces in the age of digitization and discusses how a "knowledge management 4.0" should look like. Logistics and Supply Chain Management are used as application area as they form the backbone of the interconnected physical world.

Keywords: knowledge management, KM 4.0, Industry 4.0, Logistics 4.0

1 Introduction

Internet of Things, Internet of Services, Internet of People, digitization, integration, comprehensive networking, interconnectivity through communication – these are all terms used in the context of what is called the fourth industrial revolution or Industry 4.0: advancing from embedded systems, e.g. programmable machines, to cyber-physical systems (CPS), i.e. communicating and thinking machines. This transformation is powered by nine technological advances (see Figure 1) leading to interconnected sensors, machines, workpieces, and IT systems within a cyber-physical system (Rüßmann et al., 2015). The internet and supporting technologies serve as backbone to integrate physical objects, human actors, intelligent machines, production lines and processes across organization boundaries to form an intelligent, networked and agile value chain (Ganzarain and Errasti, 2016). Communication entities communicate with each other and utilize data from the production owner during the entire life cycle of systems without respect to border among enterprises and countries. Smart,

autonomous, self-learning factories are promoted, which can provide more individualized and customized products (Zezulka et al., 2016).

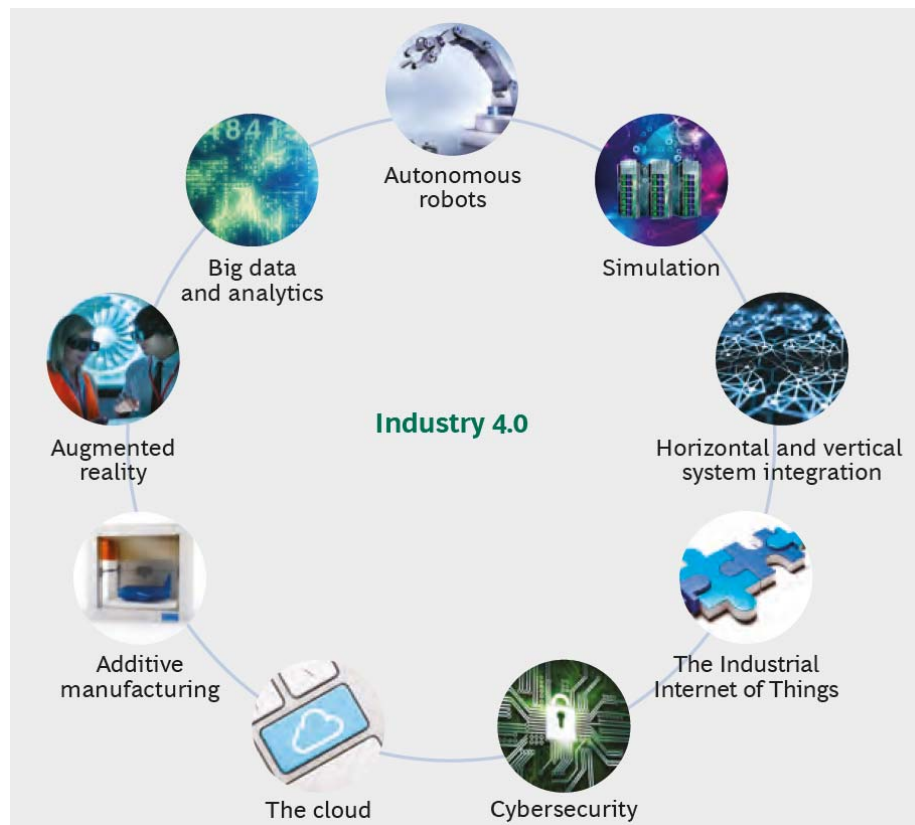


Figure 1: Technologies transforming industrial production (Rüßmann et al., 2015, p. 3)

Implementation of Industry 4.0 aims to achieve a higher level of operational efficiency and productivity, as well as a higher level of automatization (Lu, 2017). The potential impact of Industry 4.0 on producers and their labour force as well as on companies that supply manufacturing systems is widely expected to be enormous (Rüßmann et al., 2015). Continuous resource productivity and efficiency will solve today's challenges related with resources and energy efficiency, urban production and demographic change (Ganzarain and Errasti, 2016). This is achieved by a (partial) transfer of autonomy, intelligence and autonomous decisions to machines based on immediately available data giving a full picture on the current situation. These real-time data directly acquired from systems, processes, products, materials also allow for changes in knowledge acquisition and use to manage and control those value-creation activities. New functionalities of Knowledge Management (KM), like e.g. instant availability of any kind of content or unlimited information sharing between people or things, become possible (Roblek et al., 2016). The aim of KM to make knowledge as a strategic resource available to value creation processes in companies and to unlock its developmental potential is more realistic to be achieved.

Against this background the paper wants to contribute to discussions to what extent knowledge management needs to be adapted to digitization or can directly benefit from it. Logistics as the backbone of nowadays interconnected physical world is used as example. Based on an analysis of the current state of implementation of KM in logistics and supply chain

management (Section 2), the paper illustrates the impact of Industry 4.0 on logistics by use of technologically-driven key evolutions (Section 3) and analyses challenges KM faces in the age of digitization (Section 4). Discussions lead to conclusions on how a “Knowledge Management 4.0” should look like (Section 5).

2 Knowledge management in logistics and supply chain management

Logistics aims at providing the right goods or services of the right quantity and quality at the right price to the right place (or person or organization) at the right time (ELA, 2004). Supply Chain Management is the organization, planning, control and execution of the products flow from development and purchasing, through production and distribution, to the final customer in order to satisfy the requirements of the market cost-effectively (ELA, 2004). Today, logistics processes and systems increase in complexity; global networking is a need to cope with the growing diversity of logistics problems. Because of this, and by commonly accepted theory, knowledge has become a strategic resource in logistics and supply chain management (Tomé and Neumann, 2014). The management of this strategic resource has been on the agenda of logistics companies since the mid-1990s, but still has not unfolded its full potential in organizational practice. Even worse, it had lost a lot of its credibility in logistics practice because of a wrong focus on technological aspects only without paying attention to organizational culture and the involvement of people. Because of this the KM promise was not fulfilled and logistics companies further slowed down their explicit investment and interest in KM. However, logistics companies implicitly continued to depend on KM to ensure their success, but they also continued to suffer from the problem of how to manage better knowledge, addressing it exactly from the process point of view. Today, KM slowly returns into focus in logistics companies.

Consequently, some important studies on the link between KM and logistics have been published (Neumann and Tomé, 2017). They focussed on

- the importance of KM creation in reverse logistics in order to reduce the high level of uncertainty of those activities;
- the relation between KM in logistics and the process of globalization in order to enable companies to differentiate over their rivals based on logistics service and supporting KM practices;
- the increasing importance of knowledge sharing in supply chains and networks of growing complexity;
- the exploration of KM practices implemented by 3PL (third-party logistics service) providers, i.e. firms “bundling” together multiple logistics services for use by customers, operating in Italy and Sweden and the main barriers slowing down the adoption of such practices.

In a most recent study, Kianto et al. (2018) report on survey on the current state of KM implementation in small- and medium-sized enterprises (SME) in the logistics sector in Finland. Findings show that Finnish logistics SMEs focus on acquiring knowledge by recruiting and providing compensation for knowledge sharing, creation and utilisation. In contrast to

this companies lack a strategic approach towards management of knowledge resources, training, and development of employees and utilisation of modern information technology. Amongst others, authors propose to utilize KM practices in the logistics industry to grasp opportunities presented by the current transitional period of on-going major changes such as digitalisation.

Digitalization (culminating in the fourth industrial revolution) needs to be seen as both, a challenge to logistics companies and supply chains or networks introducing and requiring severe changes in systems, processes, and their environments and an opportunity for KM to get another boost. The latter hope is mainly related to overcoming the lack of data for in-depth analysis hindering the development of company-specific, hands-on guidelines for KM implementation. On the other hand, the fundamental question on how to get employees on board when it comes to KM becomes even more crucial seeing the increasing automation level in the logistics world and growing amount of machine-operated decision-making processes in supply chain.

3 Logistics 4.0

Industry 4.0 is THE topic currently concerning industrial production as a whole. Its main features are:

- Intelligent systems in production and logistics;
- Highly adaptable and modular manufacturing and logistics systems;
- Sustainable and advanced manufacturing technologies;
- Automation technology and human-machine interaction.

From this it becomes clear that this industrial revolution also changes logistics and transforms demands regarding logistics organisation. The Internet of Things can improve logistics and supply chain efficiency by providing information that is more detailed and up-to-date than currently, reducing counterfeiting and improving product traceability (Roblek et al., 2016). This aspect of data, turned into actionable intelligence and ultimately (autonomous, semi-autonomous, human) actions is key to smart supply chain management and logistics in Industry 4.0, often called Logistics 4.0. This term refers to an automated, intelligent and increasingly autonomous flow of assets, goods, materials, and information between the point of origin and the point of consumption and the various points in-between.

With a growing level of digitization in Logistics 4.0 the flow of information more and more replaces the demand for physical flows of materials and goods. This effect is nicely to be seen in additive manufacturing which is one of the technological drivers in the transformation of industrial production (see Figure 1). Additive Manufacturing is a concept whereby different processes are used to physically replicate 3D objects created by computer-aided design (CAD). This is a new way to produce objects by adding material, unlike traditional subtractive processes such as machining, drilling, or different cutting processes. These older, more conventional techniques entail removing material from an initial volume in order to obtain the desired shape. Additive manufacturing processes eliminate much of the traditional

manufacturing set-up requirements: they do not require any tooling design (mold or dies, plastic injection or forging tools) or defining or organizing different manufacturing steps (like machining or milling). Instead, you can go almost instantly from the 3D design file to the physical object itself, which represents increased accessibility and a significant time savings in the product development cycle. Seamless integration of advanced manufacturing capabilities with digital infrastructures allows for capturing, generating, and spreading intelligence through improved monitoring, analytics, modelling and simulation. All these aspects throw traditional production and management systems aside and call for a complete overhaul of businesses, procedures, and structures (Longo et al., 2017).

3D printing is one of the key technologies in this process being applied in many businesses and for many purposes, e.g. rapid prototyping or spare parts production, already. In manufacturer-driven spare parts production the manufacturer makes spare parts on demand and the customer receives a ready-to-assemble part. If this process is driven by the customer, the manufacturer provides a printable 3D model of the spare part only. The customer prints (i.e. manufactures) the spare part directly at the own premises without any need for physical spare parts logistics. Alternatively, also other actors in the traditional supply chain like logistics service providers (acting as distributors) or retailers could host 3D printing as a service. However, the closer the manufacturing process of 3D printing moves towards the customer the more significantly spare parts logistics and the supply chain change (see Figure 2):

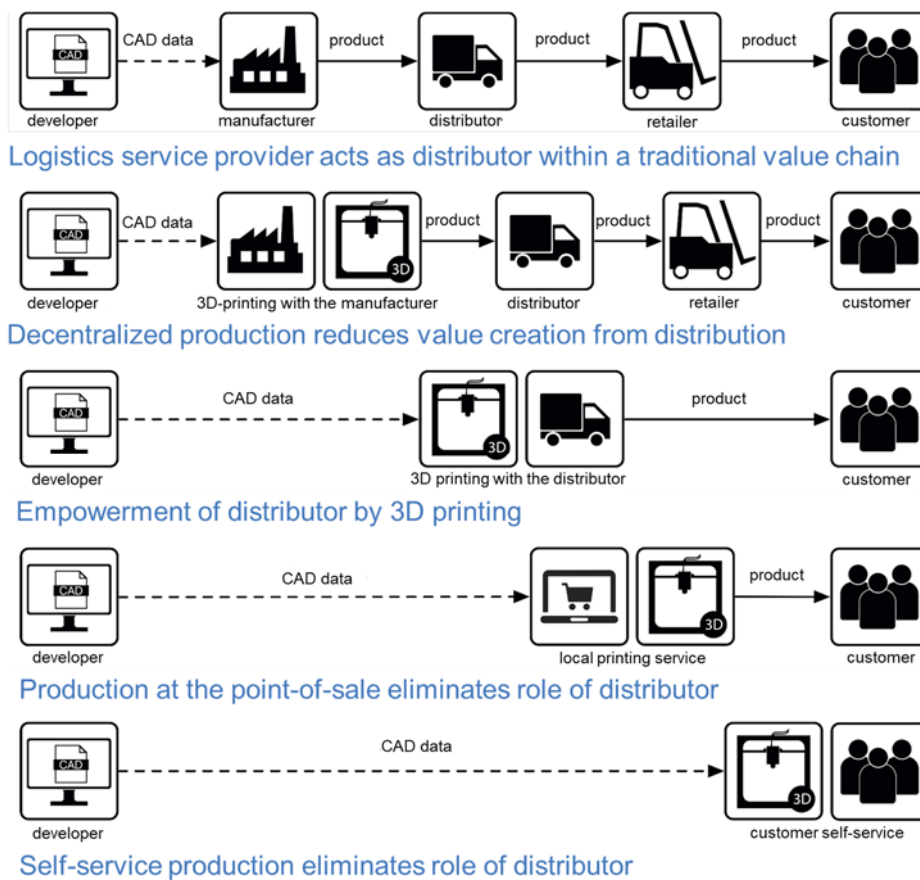


Figure 2: How additive manufacturing changes spare parts logistics (adapted from Thomas et al., 2016)

- Supply chains become more direct, shorter, more agil.
- The need for traditional transportation-related activities concerning spare parts is reduced. However, raw material for 3D printing still needs to be provided where it is needed which does not make all physical movements obsolete.
- Warehouses and distribution centres for spare parts are not needed anymore.

Additionally, shifting the manufacturer’s role to other partners in the supply chain allow for and require new business models with them. In the end, digitization and digitalization lead to the rise of 4PL (fourth-party logistics service) providers, i.e. firms neutrally managing the logistics process (and even 3PL providers) regardless of what carriers, forwarders, or warehouses are used. Furthermore, disruption is expected as the shifting relationships in logistics and the technology-driven capabilities enable new players at the 4PL market. Here, data become items to be moved and knowledge becomes a product to be sold demanding for KM processes and requesting new functionality with them.

The convergence of the virtual and physical worlds has given rise to the Smart Factory. This integrates artificial intelligence, machine learning, automation of knowledge work, and machine-to-machine communication with the manufacturing process (CRO Forum, 2015). Thus, the Smart Factory represents a leap forward from more traditional automation to a fully connected and flexible system allowing for semi-autonomous decision making in physical factory operation. Production and administrative processes are meshed with each other via IT systems in order to optimize the use and capacity of machines and lines. This way, agile production systems are created responding to fast changing consumer markets. The factory can be modified and expanded at will; it combines all components from different manufacturers and enables them to take on context-related tasks autonomously (James, 2012).

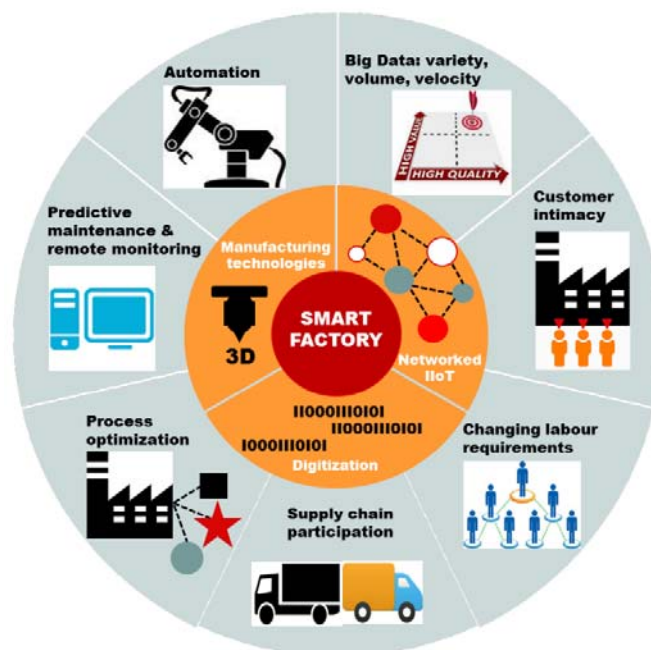


Figure 3: The smart factory concept (CRO Forum, 2015, p. 10)

The Smart Factory will fundamentally change how products are invented, manufactured and shipped. At the same time it will improve worker safety and protect the environment by enabling low-emissions and low-incident manufacturing. These advances in the way machines and other objects communicate and the resulting way in which decision-making moves from humans to technical systems means that manufacturing becomes “smarter”. Figure 3 shows key technologies underpinning these developments.

The Smart Factory approach does not change operation and design of production systems only, but strongly influences design, operation and control of logistics processes and systems. In this way, the Smart Factory forms the basis for a Smart Logistics. Here, all partners (supplier, manufacturer, wholesaler, retailer, and customer) are interconnected and the supply chain transforms into a demand chain. Real-time data processing, intelligent boxes, cloud computing etc. contribute to reduced inventory with the manufacturer, more transparent supply chains, long-term relationships between supplier and manufacturer. These economic advantages go in line with a quite limited role of a human in a Smart Factory caused by the automatic gathering and processing of data about processes and production machines limited (Akbarinasaji and Homayounvala, 2017). Nevertheless, building a Smart Factory cannot be limited to new technical solutions for manufacturing only, but needs to be based on knowledge based on

- the experience (from earlier earlier production cases) of the whole company,
- analysis and exchange of of a large amount of current data, and
- rapid testing of many alternative solutions through advanced simulations

(Zawadzki and Zywicki 2016). In other words, increased KM functionality with regard to data processing, experience management and intelligent simulations form the basis for an adequate Smart Factory design process. Furthermore, coexistence of human workers and automated machines, i.e. robots, is a mandatory feature.

In human-robot collaboration, the robot assists the human operator, i.e. the machine does not replace the human, but complements his/her capabilities and relieves him/her of arduous tasks. These can include overhead work, for example, or the lifting of heavy loads. Autonomous, collaborative robots (cobots) are also used to supply production workstations. This way, human and machine work hand in hand. The human operator controls and monitors production, the robots perform the physically strenuous work. Both contribute their specific capabilities: a decisive principle of Industry 4.0. In the factory of the future, there is no separation between automated and manual workstations. Humans and robots collaborate optimally – without separation and without safety fencing.

As illustrated by Figure 4 human-robot collaboration is the highest level of human-robot interaction. Here, humans and robots are directly (e.g. haptically or aurally) in contact whereas in human-robot coexistence both just work in common workspace operating on their specific tasks. In human-robot cooperation humans and robots work on the very same aim and fulfil requirements of time and space at the same time, but without direct interaction (Schmidtler et al., 2015).

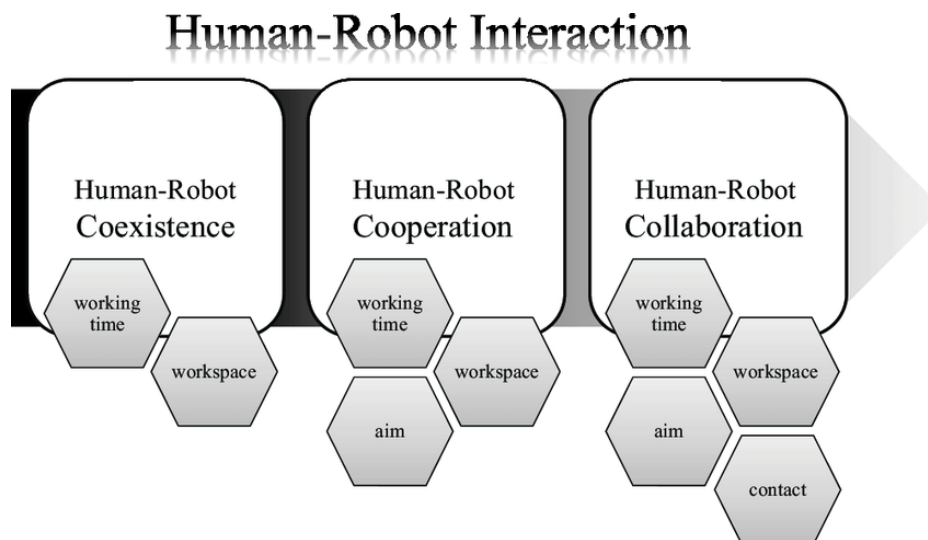


Figure 4: Classification of Human-Robot Interaction in terms of working time, workspace, aim, and contact (Schmidtler et al., 2015, p. 84)

As a result from introducing additive manufacturing, Smart Factory and human-robot collaboration production systems and processes, but also logistics and supply chains will change tremendously. In Logistics 4.0 flows of data and information, i.e. handling of logical items, will be of even larger importance than in traditional logistics. This allows (and probably requests) logistics service providers to offer additional services beyond handling physical items. New business models are required treating data and information (and to some extent even knowledge) as product (replacing physical products). In addition, these developments will change the human working environment, too. Simpler jobs disappear and more complex tasks require more interdisciplinary knowledge and wider-scale competences with human labour force at both levels, management and operation. Here, KM becomes mandatory for sustainable success.

4 Knowledge management in the age of industry 4.0

For thousands of years humans manufactured products, first for their own use only, later on behalf of others or even for selling them. In these so-called pre-industrial times workers run the entire process for all products (prehistoric to ancient times) or later for a single product at least (ancient times to Middle Ages). They were pure generalists or intermediate specialists knowing everything about a product and the steps required to make it (Dumas et al. 2018). Entering into industrial times, situation changed and workers became pure specialists with regard to the machines they were operating or work steps they were performing. With each evolutionary step (called industrial revolution) workers' focus narrowed down more with regard to the entire product and production process on one hand, but the kind and amount of knowledge required to perform successfully became more and more complex and multi-faceted.

The first industrial revolution started at the end of the 18th century with the advent of the steam engine. Mechanisms got used to take advantage of water power and steam power for

industrial production. This not only severely changed what and how to produce, but also modified society with trains, new jobs, etc. Electricity triggered the second industrial revolution. With the start of the 20th century individual workplaces and machines could be linked into assembly lines which allowed for mass production and Taylorism. Jobs changed again with workers becoming specialists and because of this losing the view on entire products and the understanding of their individual contribution to it. Instead they now focus on a single step for a single product only meeting the demand for highly efficient performance. In the 1970s, a third industrial revolution appeared. It was based on computers and automation leading to the rise of robotics in manufacturing, industrial connectivity, and, specifically, the birth of the Internet. This changed society much more than industrial production; the term information society clearly expresses the value and importance information got.

Further technological advances led to the latest evolutionary step, the fourth industrial revolution, happening just now (or having happened in the last few years). Large scale communication with and between machines, i.e. almost completely networked environments, changed production environments into cyber-physical systems. Again, this goes in line with a social revolution; knowledge society has arrived.

Regardless of how autonomous we want systems to be, an important human element remains. Supply chain management is changing in the decentralized context of Industry 4.0; nevertheless it needs people to plan and take actions as not all actions can be or should be automated. Therefore, the role of the human worker in Industry 4.0 is still very important and essential, even though it will change on both levels of a production system, shopfloor and operational management:

- On shopfloor level, simple tasks will be more and more automated with the remaining tasks mostly consisting of problem solving. Besides, these tasks will become more and more complicated as the complexity of machines and plants within the smart factory will increase rapidly (Kreimeier et al. 2014). Consequently, to master this complexity the human operator needs to have more knowledge and competencies than ever before (Ulrich et al. 2015). Thus, new assistance and knowledge services are required to enable employees to deal with this complexity.
- On operational management level, i.e. in production planning and control (PPC), all processes in a factory can be depicted in real-time now. Employees will be confronted with a high amount of information and data, generated by the entire infrastructure of cyber-physical systems. The challenge will be to summarize, prepare and interpret the data (Prinz et al. 2014) which will increase complexity of work.

Generally, the complexity of the Industry 4.0 leads to enhanced (IT-dominated) technologies, workplace and business models. Dombrowski and Wagner (2014) foresee largely changing working conditions in the smart factory with regard to requirements, resources and workloads; requirements mainly for professional, social, methodical and personal competencies will increase. On the other hand, changes in the workplace environment not

only increase requirements, but also go in line with an increased possibility of and stronger demand for knowledge-based support. Ulrich et al. (2015) identified a need for tools that:

- adapt themselves intelligently to the knowledge level and tasks of the human operators;
- integrate and connect knowledge sources available in the company;
- generate useful recommendations of actions.

They propose an APP-based service seamlessly being integrated into the working environment.

The challenge will be the restructuring of jobs because some of the less-demanding occupations will quickly disappear (Kane et al 2015). Productivity gains achieved by the use of smart technologies may help to secure jobs and boost consumer demand with additional income (compensation effect), but the use of new production technologies and processes may also destroy jobs (redundancy effects). There are concerns that the redundancy effect from Industry 4.0 will pre-dominate in the long run, leading to what is known as technological unemployment (Hungerland et al. 2015). On the other hand it is respectively certain that job profiles at many workplaces are set to change and growing inner complexity of production and logistics systems does require proper workforce qualification strategies. This means that major conversion and adaptation measures will also be necessary in the fields of education and employee development (Weber 2015).

Analysing the relevance and influence of Industry 4.0 and internet-connected technologies for the creation of value for organizations and society, Roblek et al. (2016) concluded on new functionality of "IoT knowledge processes". They become possible because of big data acquired directly from goods and products, equipment and systems, or workers and customers. Data are analyzed and stored in clouds which make them and any information derived from them available anywhere and anytime in real time. There are no (technical) limitations anymore for sharing information and collaborating between people, between people and things, and between things. In the end, Industry 4.0 concepts lead to new KM functionalities and eventually even require a transformation of KM towards a KM 4.0.

5 Summary and conclusions

Industry 4.0 will make it possible to gather and analyse data across machines, enabling faster, more flexible, and more efficient processes to produce higher-quality goods at reduced costs. This in turn will increase manufacturing productivity, shift economies, foster industrial growth, and modify the profile of the workforce – ultimately changing competitiveness of companies and regions (Rüßmann et al., 2015). Implications on KM in logistics and supply chains will be high.

Summarizing the current situation of KM in logistics and supply chain management it has to be stated that

- KM is still just quite hesitantly implemented in logistics companies.

- the lack of data for in-depth analysis hinders development of company-specific hands-on guidelines for KM implementation.
- the question for how to get employees (intrinsically) on board when it comes to KM still remains unanswered.

The ongoing fourth industrial revolution will change logistics and supply chain management tremendously. As in Logistics 4.0 information and knowledge become a product, too, new business models are required. Furthermore, the role of human workers and the way of working will change requiring new competencies in all aspects. This evolution of competence requirements, but also further strategic developments, changing public policies, and the opportunity as well as demand for new business models affects further development of KM. As a consequence Knowledge Management in the age of Industry 4.0 requires transformation towards Knowledge Management 4.0.

The question for what KM 4.0 might be still should be subject of further research and discussion. Generally, there are two possible destinations this developmental process might end up at.

- **Hypothesis 1:** Industry 4.0 is an enabler of KM

Industry 4.0 finally provides the environment for KM that it really needs. Because of this, in Industry 4.0 KM finally can operate and be effective as ideal-world concepts dreamed of.

- **Hypothesis 2:** Industry 4.0 leads to or even requires KM 4.0

Industry 4.0 requires changes within KM just as in other socio-economic systems or business sectors including human actors, too. As a result KM undergoes the next evolutionary step that can be called Knowledge Management 4.0. Large-scale digitization and communication are the triggers in this development.

North et al. (2018) call the 21st century the “Digitized Knowledge Society” characterized by: digitization of everyday life and value creation; cognitive, social, collaborative, and networked systems; Augmented Intelligence; digital penetration of professions and education. Knowledge within this is shifted to a new level, knowledge 4.0. Knowledge management needs to join this evolution mastering challenges and benefiting from chances.

References

Akbarinasaji, S., Homayounvala, E., 2017. A novel context-aware augmented reality framework for maintenance systems. *Journal of Ambient Intelligence and Smart Environments* 2017(9)3, 315-327.

CRO Forum, 2015. *The Smart Factory – Risk Management Perspectives*.

Dumas, M., La Rosa, M., Mendling, J., Reijers, H.A., 2018. *Fundamentals of Business Process Management*. 2nd ed., Springer.

ELA (European Logistics Association), 2004. *The ELA Terminology in Logistics*.

- Ganzarain, J., Errasti, N., 2016. Three Stage Maturity Model in SME's towards Industry 4.0. *Journal of Industrial Engineering and Management JIEM*, 2016 – 9(5): 1119-1128.
- Hecklau, F., Galeitzke, M., Flachs, S., Kohl, H., 2016. Holistic approach for human resource management in industry 4.0. *Procedia CIRP*, 54, 1-6.
- Hungerland, F., Quitzau, J., Zuber, C., Ehrlich, L., Growitsch, C., Rische, M.C., Haß, H.J., 2015. *The digital economy* (No. 21c), Stragey 2030 - Wealth and Life in the Next Generation. Available from <http://www.econstor.eu/handle/10-19/121322> [accessed 30 June 2018].
- James, T., 2012. Smart Special - Smart Factories. *E&T Engineering and Technology*, publ. June 18, 2012. Available from <https://eandt.theiet.org/content/articles/2012/06/smart-special-smart-factories/> [accessed 31 July 2017]
- Jimenez, E., 2017. Industry 4.0, the fourth revolution of industrial production: A simulation perspective. Keynote at *I3M 2017*
- Kane, G.C., Palmer, D., Phillips, A.N., Kiron, D., 2015. Is your business ready for a digital future? *MIT Sloan Management Review*, 56, 37.
- Kianto, A., Hussinki, H., Vanhala, M., Nisula, A.-M., 2018. The state of knowledge management in logistics SMEs: evidence from two Finnish regions. *Knowledge Management Research & Practice*, online: <https://doi.org/10.1080/14778238.2018.1488523> [accessed 30 June 2018].
- Kreimeier, D., Kreggenfeld, N., Prinz, C., Igel, C., Ullrich, C., 2014. Intelligente Wissensdienste in Cyber-Physischen Systemen. *Industrie Management* 2014(6):25–9 (Intelligent knowledge services in cyber-physical systems, in German).
- Longo, F., Nicoletti, L., Padovano, A., 2017. Smart operators in industry 4.0: A human-centered approach to enhance operators' capabilities and competencies within the new smart factory context. *Computers & Industrial Engineering* 113 (2017) 144-159.
- Lu, Y., 2017. Industry 4.0: A survey on technologies, applications and open research issues. *Journal of Industrial Information Integration* 6 (2017) 1-10.
- Neumann, G., Tomé, E., 2017. 10 Years After: An Update on the Role of Knowledge Management in Logistics Companies. In: Marimon, F.; Mas-Machuca, M.; Berbegal-Mirabent, J.; Bastida, R. (eds.), *Proceedings of the 18th European Conference on Knowledge Management, ECKM*, 752-759.
- North, K., Maier, R., Haas, O., 2018. Value Creation in the Digitally Enabled Knowledge Economy. In: North, K., Maier, R., Haas, O. (eds) *Knowledge Management in Digital Change*. Springer, Cham.
- Prinz, C., Jentzsch, D., Kreggenfeld, N., Morlock, F., Merkel, A., Müller, E, 2014. Concept of Semi-Autonomous Production Planning and Decision Support Based on Virtual Technology. *Proc. of Flexible Automation and Intelligent Manufacturing*, FAIM, 1049-1056.
- Prinz, C., Morlock, F., Freith, S., Kreggenfeld, N., Kreimeier, D., Kuhlenkötter, B., 2016. Learning Factory modules for smart factories in Industrie 4.0. *Procedia CIRP* 54 (2016) 113-118.
- Roblek, V., Mesko, M, Krapez, A., 2016. A Complex View of Industry 4.0. *SAGE Open*, April-June 2016: 1-11.
- Rüßmann, M., Lorenz, M., Gerbert, P., Waldner, M., Justus, J., Engel, P., Harnisch, M., 2015. *Industry 4.0: The Future of Productivity and Growth in Manufacturing Industries*. The Boston Consulting Group.
- Schmidtler, J., Knott, V., Hölzel, C., Bengler, K., 2015. Human Centered Assistance Applications for the working environment of the future. *Occupational Ergonomics* 12 (2015) 83-95.
- Thomas, O., Kammler, F., Zobel, B., Sossna, D., Zarvic, N., 2016. Supply Chain 4.0: Revolution in der Logistik durch 3D-Druck. *IM+io Fachzeitschrift für Innovation, Organisation und Management* 01 (2016) 58-63. (Supply Chain 4.0: revolution in logistics through 3D printing, in German)

Tomé, E., Neumann, G., 2014. Knowledge management in logistics industry organizations. In: Örtenblad, A. (ed.): *Handbook of Research on Knowledge Management: Adaptation and Context*, Cheltenham (UK): Edward Elgar, 173-188.

Ullrich, C., Aust, M., Blach, R., Dietrich, M., Igel, C., Kreggenfeld, N., Kahl, D., Prinz, C., Schwantzer, S., 2015. Assistance- and Knowledge-Services for Smart Production. Proceedings of the *15th International Conference on Knowledge Technologies and Datadriven Business (i-KNOW)*.

Weber, E., 2015. Industrie 4.0 - Wirkungen auf Wirtschaft und Arbeitsmarkt. *Wirtschaftsdienst*, 95, 722-723 (Industry 4.0 - Impact on the Economy and Labour Market, in German).

Zawadzki, P., Zywicki, K., 2016. Smart product design and production control for effective mass customization in the Industry 4.0 concept. *Management and Production Engineering Review*, 7 (2016) 3, 105-112.

Zezulka, F., Marcon, P., Vesely, I., Sajdl, O., 2016. Industry 4.0 – An Introduction in the phenomenon. *IFAC-PapersOnLine* 49-25 (2016) 008–012.

Digital Readiness Analysis (DiREA) of Logistics Service Providers

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Abstract: Logistics is a field which can benefit to a great extent from all the different aspects of digitalisation. Contradictory to that, many logistics service providers remain in a waiting position pretending to wait for the new needs of their customers. The purpose of the paper is to identify realistic pathways for logistics service providers (LSPs) to handle the challenges of digitalisation and develop strategies to become equal digitalisation partners of their customers. A survey amongst LSPs was conducted to analyse the readiness of LSPs for jumping into the digital world. Technological, organisational, financial as well as competence oriented readiness are part of this survey. The focus are digital processes on the one hand and digital business models in logistics on the other hand. The theory for this paper is based on disruption of business models, innovation concepts and strategies in logistics as well as flexibility and adaptability of logistics systems and processes in a world of increasing dynamic and complexity. That's why the question "how digitalisation can support in dealing with complexity?", will be raised, too. Looking to the results of the study there is a twofold acquisition of knowledge. On the one hand it leads to a much clearer view regarding the challenges and obstacles LSP's have to cope with, when preparing for the digital world. The study delivers benchmark results for the participants, too. On the other hand realistic strategies will be provided which can help LSPs to become a leader in the fast changing digital world. Up to now there is no digital readiness analysis regarding the logistics sector available. For the first time now there is a kind of orientation available for LSPs and their customers regarding the digital readiness. It has to be investigated if this can become a general standard for digital readiness investigations and the future developments in this field.

Keywords: Digitalization, Logistics, Industry 4.0, Internet of Things (IoT), Cyber-physical-systems (CPS), Disruption

1 Introduction

Digitalization is one of the most important drivers of business as well as the changing of existing business models and the development of new business models during the last years. Though digitalization as such is nothing new. It started already in the middle of the last century

when computers became more and more available and were introduced in most of the business processes. But today we can see a totally new quality of digitalization.

The following paper analyses the reasons for that and the strategic impact for the companies. Especially the logistics sector offers a lot of promising use cases for the new technologies as well as new strategies and business models. Though a lot of companies in this sector know that there is a need for change at the same time the questions arises what has to be changed in a specific company, how to prepare for the digital future, what competences will be needed, how to get the management as well as all the employees on a new track?

In chapter two an analysis is done regarding the new understanding of digitalization as well as the specific drivers for it. This will be followed by a close view to the actual developments and challenges the logistics industry has to face. From these two chapters the need for the study becomes obvious and an outline regarding the concrete preparation and realization of the study will be described. Chapter five shows some of the main results and gives some answers to the questions mentioned above. Finally an outlook and further need for research will be discussed.

2 Drivers for digitalization

Although there are a lot of different reasons for the hype of digitalization today, some of the main drivers should be mentioned first.

When we speak about digitalization it has to be mentioned this already led to the idea of revolutionary change of our industrial and even economic system often called industry 4.0, the fourth industrial revolution. This description is used to emphasize the fundamental change of industry as well the whole society which might be comparable to the three industrial revolutions in the past.

Digitalization, as we understand it today, means that information and communication technology is integrated to a highly intensive degree in all processes and business activities. It not only delivers detailed realtime data and information but supports decision taking on the one hand while taking routine decisions itself on the other hand, too. This obviously is based on some important technological developments.

High performance ICT-systems

According to the well known Moore's Law the amount of integrated circuit elements on a specific surface doubled every 18 month since 1965. This leads to nowadays possibility to integrate ICT into more or less every item. An obvious example are the new generations of smartphones which offer functionalities which were even not available on mainframe computers some years ago. In an industrial environment we are talking about embedded systems which means that we find computer chips integrated in other technical systems to ensure realtime surveillance and data exchange between different technical items (e.g. machine-to-machine communication) or to server networks respectively cloud environments.

Intelligent sensors and actuators

Closely connected to the highperformance ICT systems are the new generations of “intelligent” sensors and actuators. The integration of computer intelligence into the sensor respectively the actuator directly offers a huge amount of new controlling as well as realtime manipulating strategies for every type of processes (Sick, 2018). For example, sensors are utilized for the realtime identification of irregularities in the painting process of cars. If they detect a minimum deviation from the expected layer thickness the system can be adjusted immediately during the process to optimize the quality. No human or central server interaction will be needed anymore.

Intelligent sensors are the “eyes, ears and noses” in the digital realtime world. They play already a very important role in self-controlling systems.

Artificial intelligence, neuronal networks and deep learning

Artificial intelligence (AI) already got a tremendous importance in daily life. Looking at voice operating systems like Alexa and Siri, the customer supporting systems in online business or simply the image identification at the borders we easily can imagine the potential of this technology for the future. AI is not a new development. Already in the 1950ies AI was used for the first time. During the following years of the 20th century there has been done a lot of work on AI systems. Some of the most impressive und publicly recognized steps were the winning of a chess match by IBM’s Deep Blue against the world champion Garry Kasparow in 1997, the recognition of cats in youtube films in 2014 and the winning of a “GO”-match by Googles AI machine AlphaGo against the world champion Lee Sedol in 2016 (DHL, IBM 2018, page 3) (Nielsen, 2018). These well known examples give a first hint to the power of AI technologies. We now have reached a phase where the underlying technological development allow for totally new use cases and a lot of fields in daily business as well as all kinds of processes along the whole supply chain.

A survey of recent use cases in different fields can be found in DHL/IBM, 2018, pp.16-21. Use cases in logistics can be found in DHL/IBM, 2018, pp 22-32.

One of the very interesting and challenging developments in the field of AI is called deep learning. When in former times expert systems rely on algorithms which were dedicated to a specific problem or class of problems deep learning transfers the mechanism of the learning process within the human brain into machine learning. For deeper understanding and the specific technology refer to Goodfellow (Goodfellow et al. 2016). This offers a totally new kind of flexibility and experience show that AI machines are already able to train themselves and find solutions which no human ever found so far. Even in the field of science and research there are already a lot of use cases (Angerer 2018).

Internet of Things and Big Data

A consequence of the before mentioned smart objects and embedded systems is the so called Internet of things (IoT). The traditional internet is well known for the easy and worldwide connection of people via ICT-systems and mobile devices. The introduction of computer intelligence in a huge amount of daily devices and their linking to the internet lead to the

Internet of Things. This means that today there are not only humans communicating via the internet but a lot of technical items, too. The amount of data will increase exponentially and data security gains tremendous importance. This is especially because of the billions of new and potentially easy to penetrate access points to the internet.

On the other hand IoT and the huge amount of data, often referred to as Big Data, offer totally new possibilities for the transparency of business process and along the whole supply chain. Especially the field of predictive analytics e.g. predictive maintenance in production systems is one of the already well established use case for Big Data and the Internet of Things.

After discussing some of the drivers of the digitalization the following chapter will link the developments of the digital world to the actual development in logistics.

3 Developments and challenges in logistics

The actual discussion about the digital changes gives a clear impression that especially in the field of logistics the digital challenges as well as the opportunities are of major importance.

Figure 1 shows an overview of the developments of the last decades with an outlook to the near future.

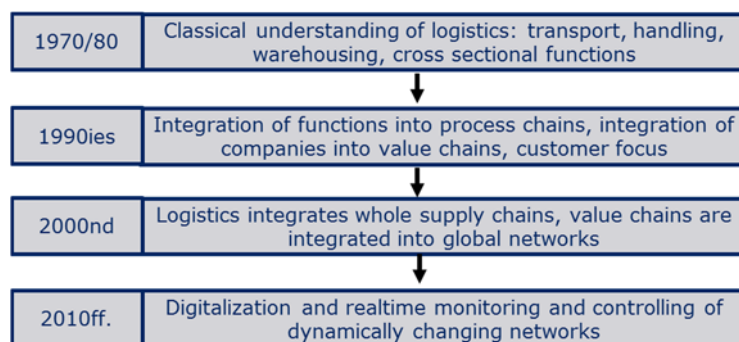


Figure 1: Developments in logistics (own figure)

In the 1970ies the overall understanding of logistics was that it covers the field of transport, warehousing and handling of goods. The understanding develops during the following decades first to an understanding as the linking function between different departments of one company or even as a link between companies. The process oriented view during the 1980ies and 90ies focused on the process view of logistics. Finally, at that time the customer becomes more and more important. With regards to the whole supply chain it became obvious that the final customer in the end takes over the position on the driving chair of the whole supply chain. Logistics became of more and more importance as well for the realization of the interface between companies (material flows, information flows, finance flows) as well as inside the production sites. In the following years the globalisation gains speed and the challenging task became the development of international and global logistics networks. Finally, digitalisation brings new challenges. It even has the potential to support the reconfiguration of global production and logistics networks. 3D printing and highly automated production systems are the key words to be mentioned here.

The digitalisation arrives at the logistics sector at a moment when the business runs quite well. This means that the managers and the managing directors of the companies have to cope with many challenges of daily business that for a lot of them there is hardly time to take a deeper look at new developments like for example in the field of digitalization (refers to personal communications with responsible persons from the field). Bigger companies may assign a special department or work together with experts from consultancy and scientific institutions. This is much more difficult for small and medium sized companies (SME's) which are typical for the logistics sector.

Besides this, it becomes more and more obvious that not only the improvement of processes will become necessary. The redesign of the still well functioning business models and value creating business strategies might become a factor of "to be or not to be" in the near future. The competition is no longer only between logistics companies. Other competitors with totally new approaches for delivering logistics services, already entered the market. The disruption of traditional business models becomes a key issue for LSPs.

Instead of Industry 4.0 sometimes people speak about logistics 4.0 already which means the conversion of logistics processes and business models into the era of the new revolution in logistics. How these approaches are able to cope with the increasing complexity is well described by Wehberg (Wehberg, 2015). A future oriented outlook regarding the planning and management in future logistics can be found at ten Hompel and Henke (ten Hompel, Henke, 2017).

The question arises if logistics service providers are already prepared for this situation. The latest trend study of the German Logistics Association (BVL) in 2017 already gave some overall insights into digital transformation processes in industry, retail and logistics (Kersten et al. 2017).

4 Design of the study

As mentioned above the digitalization offers many opportunities for LSPs on the one hand but it brings risks and challenges, too. Although there are a lot of discussions and publications regarding digitalization and all the connected topics the question arises how far digitalization already has found its way into the daily business as well as the strategic concepts of logistics service providers.

To get a first impression a basic study was designed to be able to answer the following questions:

- What is the understanding of digitalization at the LSPs? What topics do they relate to it? How do they get the relevant information?
- How is the knowledge about specific technologies? To which extent are they already used? To which extent do LSPs plan to use them in the future?
- What is the strategic and business impact of digitalization for the LSPs?
- What does digitalization mean for the innovation strategies?

- How do LSPs prepare for the future regarding the competencies of the company as such as well as the knowledge and competencies of the staff?
- What is the overall digital readiness for a specific LSP compared with the whole group of participating companies?

To answer these questions a twofold approach was applied. An online questionnaire was sent out to a well defined group of managers and managing directors of LSPs of different size. The focus was the region of Bremen and the northwestern part of Germany (Metropolitan area of Bremen and Oldenburg). Besides the questionnaire additional interviews led to a deeper understanding of the underlying reasons for specific answers. Before the real questionnaire was sent out, a pretest with selected companies was conducted to validate and quality check the questionnaire.

Figure 2 shows the panel which took part at the survey. It has to be mentioned that it was not the aim to get statistical relevance but to get an overall impression from the field as a basis for further investigations as well as an indicator for the participating companies regarding their own needs for improvement their digital future.

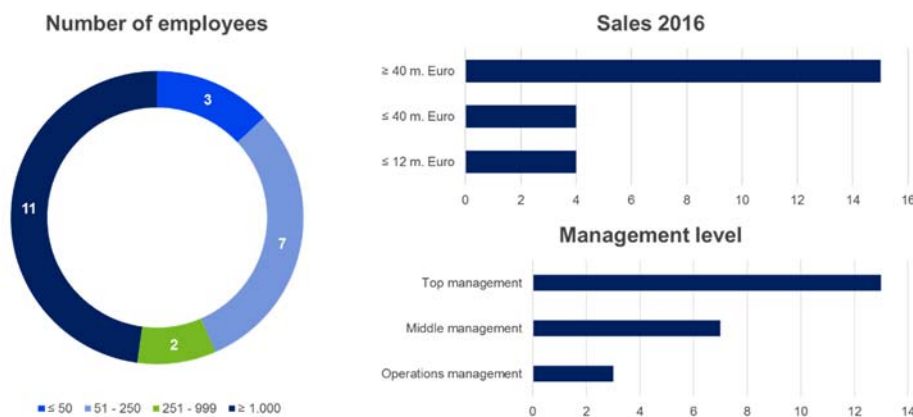


Figure 2: Structure of participating LSPs at digital readiness study (n=23) (own figure)

According to the questions mentioned above, the questionnaire was divided into five distinct parts, focussing on

1. Information
2. Technologies
3. Strategies and business models
4. Innovations
5. Employees and competencies

Every part consists of a different amount and different types of questions. Some of them requiring concrete figures, some of them requiring estimations on a well defined scale.

It was the objective to provide an overall indicator for the evaluation of the digital readiness of a company and for the comparison with other in the field. That's why every part of the questionnaire provides so called indicator questions with answers on a scale 1 to 6 with the indication 1 = very low and 6 = very highly developed. For every part of the questionnaire the

answers for these indicator questions were summarized and afterwards consolidated in a spider web. Besides that, no further weighing of criteria was applied.

The summarized spider webs give an indication for every company regarding their readiness. Spider webs for the specific fields of the questionnaire allow for further analysis and interpretation. Figure 3 shows one example for a summarized spider web.

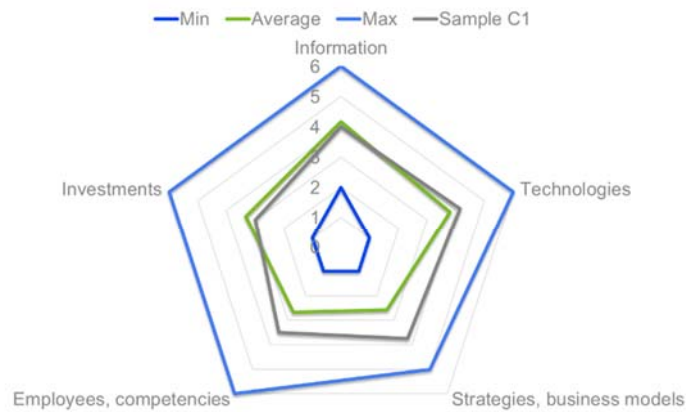


Figure 3: Summarized spider web (own figure)

After the description of the research methodology the following chapter will focus some of the findings in detail.

5 Selected results of the survey

Regarding the digital transformation the participants of the study use a variety of information sources. Most important ist the personal network followed by specialized printed media as well as internet and social media resources. Special events, congresses as well information from association are very important, too. Only very few of the participants name scientific institutions as an important source.

Figure 4 shows the results regarding the overall degree of information about the digital transformation.

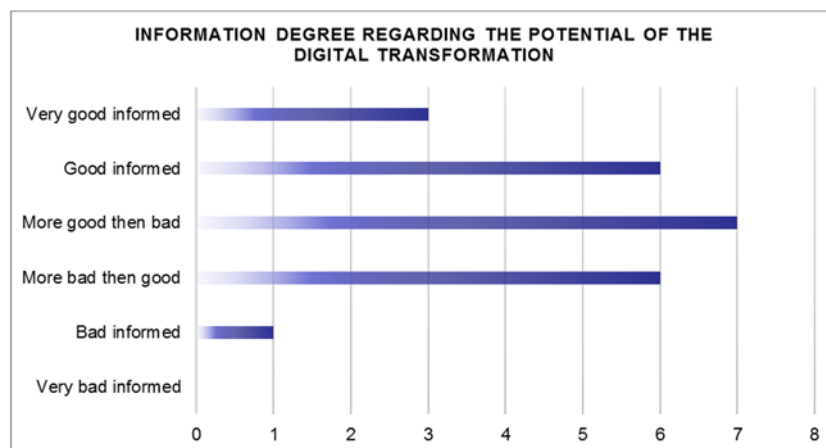


Figure 4: Information about digital transformation (own figure)

It is obvious that the tendency is a good and better degree of information. Additional interviews show that there are huge differences regarding the degree of information. This of course is a very personal estimation, too. Whereas in some cases just the knowledge of a definition or some generic basics of a technology are evaluated as being good informed you can realize that in other cases only the full and complete understanding leads to an evaluation of good or very good informed.

One of the very important questions is the actual degree of usage of technologies and systems which are kind of indicators for the digitalization activities in the companies. The results are shown in figure 5.

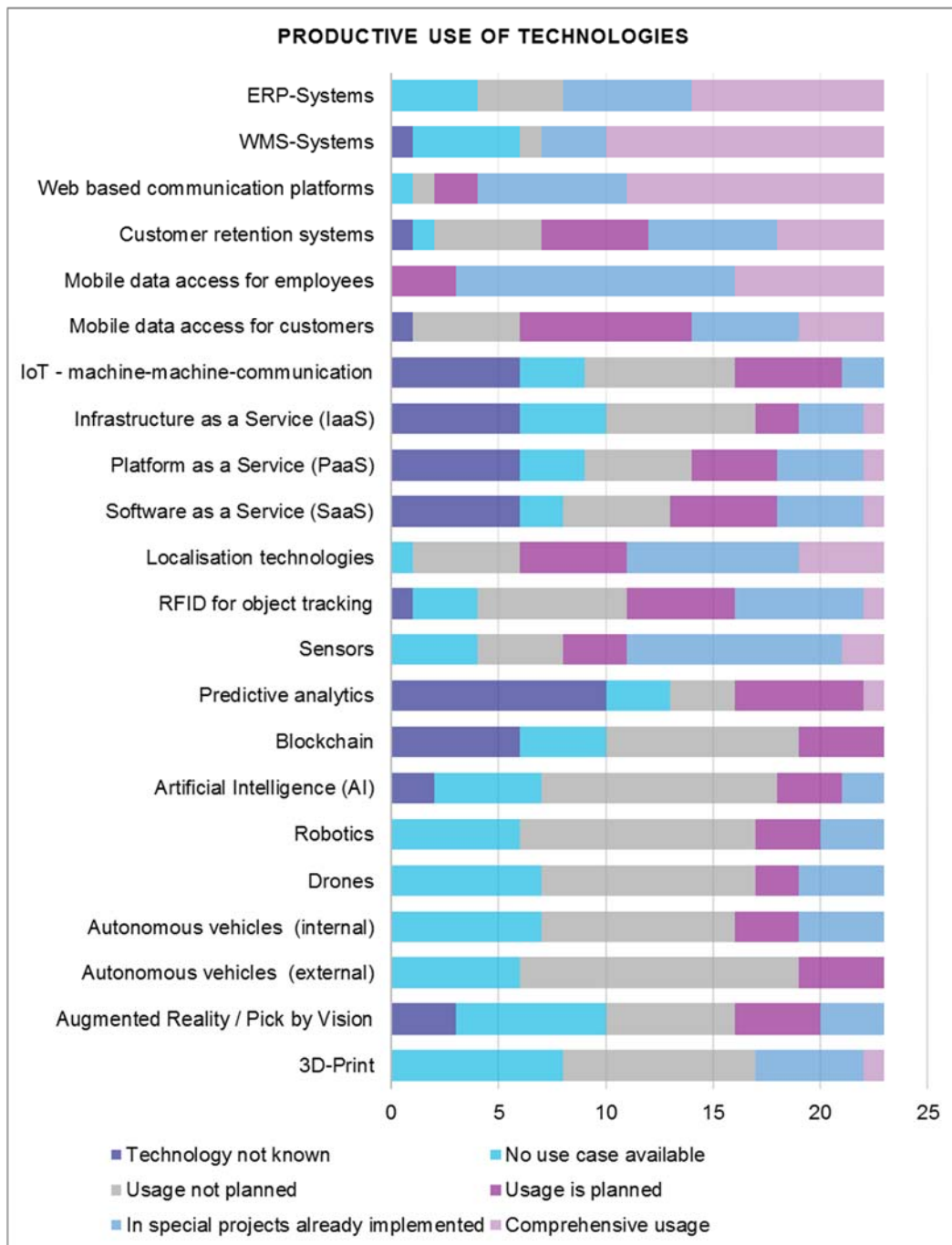


Figure 5: Degree of technology use in the companies (own figure)

It can be seen from these answers that there are widespread degrees of knowledge and use of future oriented technologies in the field of digitalization. Where some companies already make comprehensive use of a technology other don't even know about it (e.g. predictive analysis). The same holds for new kind of services like Infrastructure as a Service (IaaS), Platform as a Service (PaaS) or Software as a Service (SaaS). So many companies use these services already or plan to use them whereas nearly 25% don't even know these concepts.

Today's available technologies together with the expectations of the customers should consequently lead to a rethinking and maybe redefining of the existing strategies and in the end the business models. Existing business models, based on data and information, may be able to be extended. New business models are already in the field to take over the value generation of the companies. Figure 6 shows the actual situation at the LSPs.

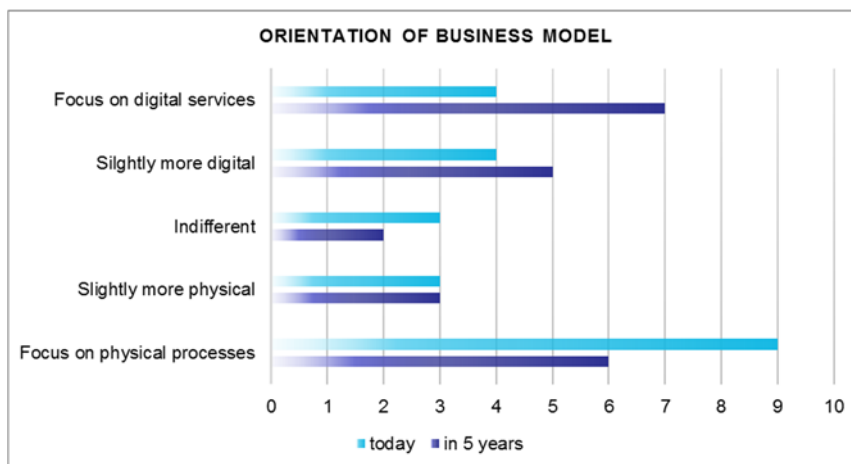


Figure 6: Business model development at LSPs (own figure)

It can easily be seen, that there will be a shift to more digital business models. It has to be mentioned, that the possibilities of shifting the business models in logistics are limited to some extent because for example goods still have to be transported somehow today and in the future.

Most of the companies are open for some kind of cooperation with start ups in specific fields. This shows that the need for fast and dynamic changes has been realized and some companies already started cooperations which they not even thought about five years ago. The figure 7 shows the basic results on that.

It can be seen that especially the development of business models for the future is a field where LSP's already make or plan to make use of cooperations with start ups. The big ones already run their own offices in start up focus cities like Berlin or even in the Silicon Valley or Tel Aviv.

Regarding the cooperation with start ups or maybe their integration or even the development of own start ups always shows the need for change in the companies' cultures. Even every single employee (on both sides), has to accept another mentality and another way of doing business.

Talking about people it becomes obvious that a need for changing or increasing competencies will be necessary for a successful future in the digital world.

This has been realized by the participants of the study, too. Figure 8 clearly shows the need for more employees with a specific IT background in their education. This becomes a challenge for the existing staff, too, because many tasks in the logistics operations and administrations and even on management level maybe will be taken over partly or totally by computers.

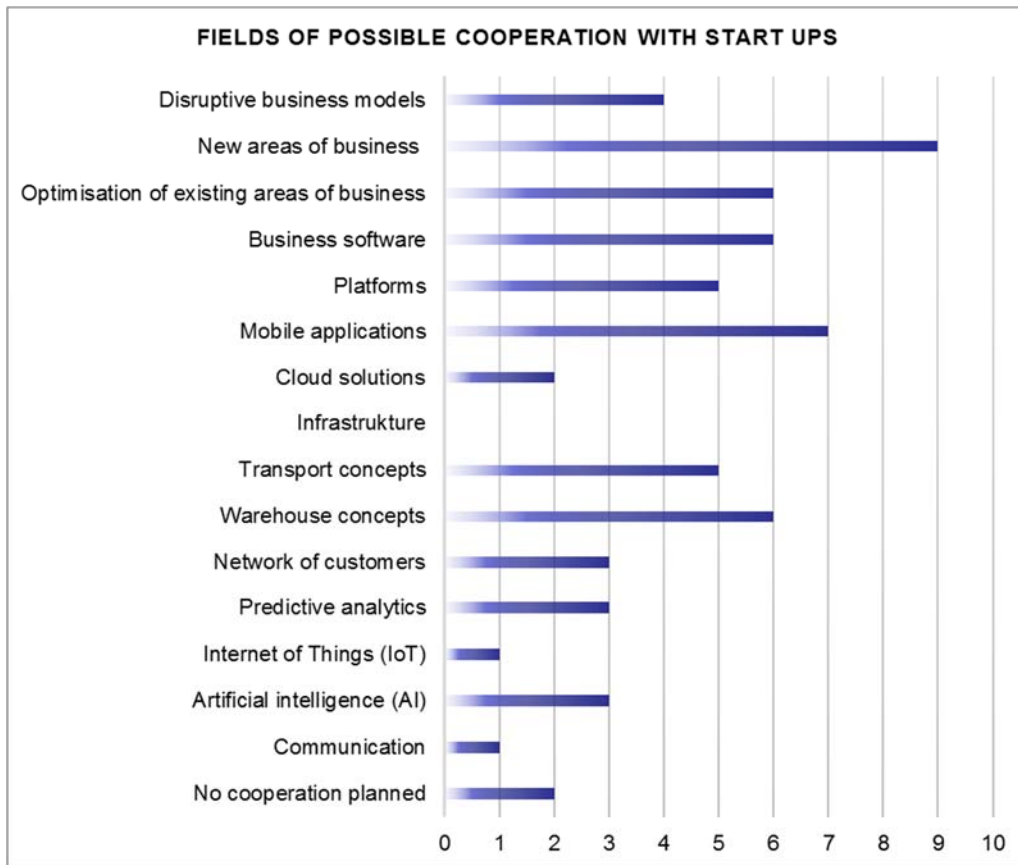


Figure 7: Cooperation with start ups (own figure)

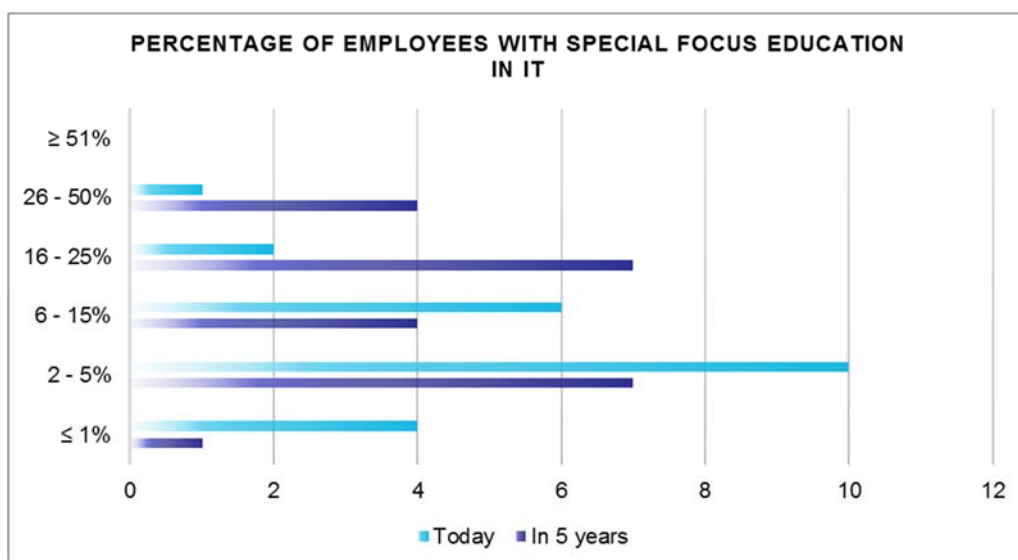


Figure 8: Need for IT based competencies (own figure)

Every future oriented strategy must be based on dedicated investments. Figures 9 and 10 show on the one hand the estimated relevance of the investments in the digital transformation (Figure 9) and on the other hand the share of investments for the digital transformation (Figure 10).

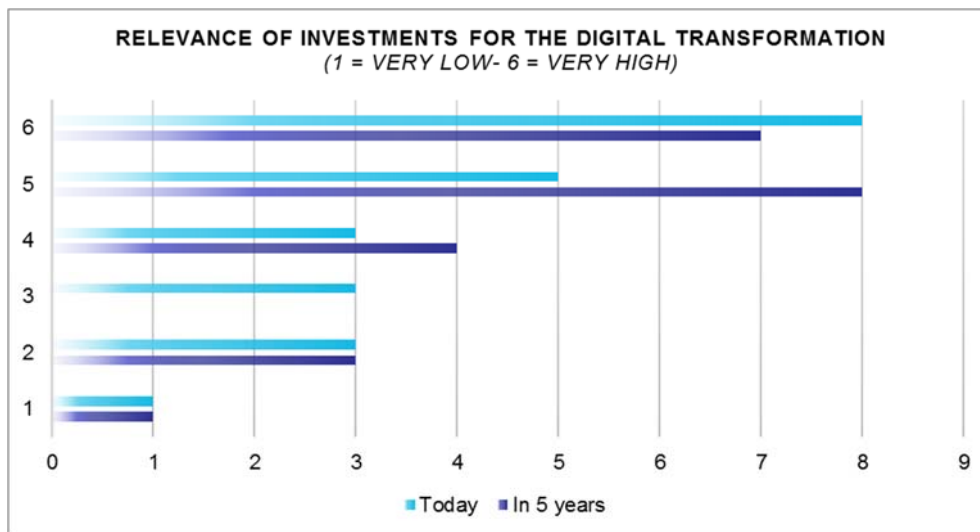


Figure 9: Relevance of investments for the digital transformation (own figure)

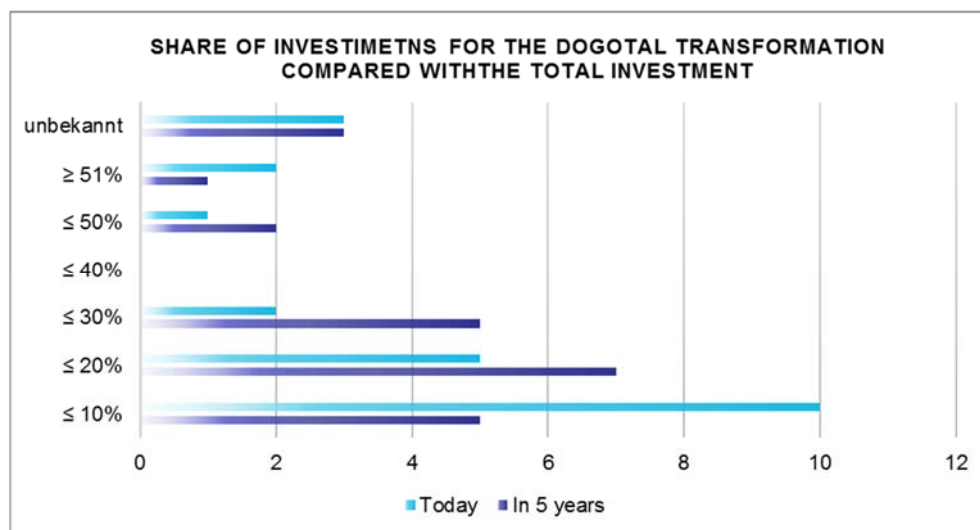


Figure 10: Share of investments for the digital transformation (own figure)

The figures show that the need for investments for the digital transformation has been widely recognized. Some companies see the need for investments more today than in five years. They obviously realize the fast changing business environment and the challenges of today.

Figure 3 already showed the summarized spider web where every company can immediately get an impression about the the actual digital readiness a glance. Behind that there are specific spider webs which show more in detail what could be the most important field of action for the future to cope with the competitors in the field of digital transformation. Figure 11 gives one example from the technological field whereas figure 12 gives an example from

the employee and company strategy and business model field. More details will be provided in the presentation.

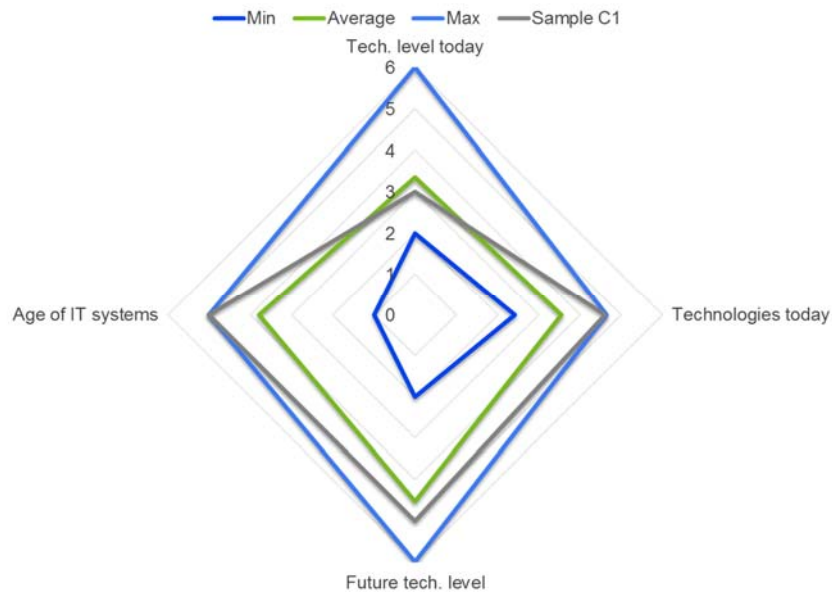


Figure 11: Detailed spider web: technologies (own figure)

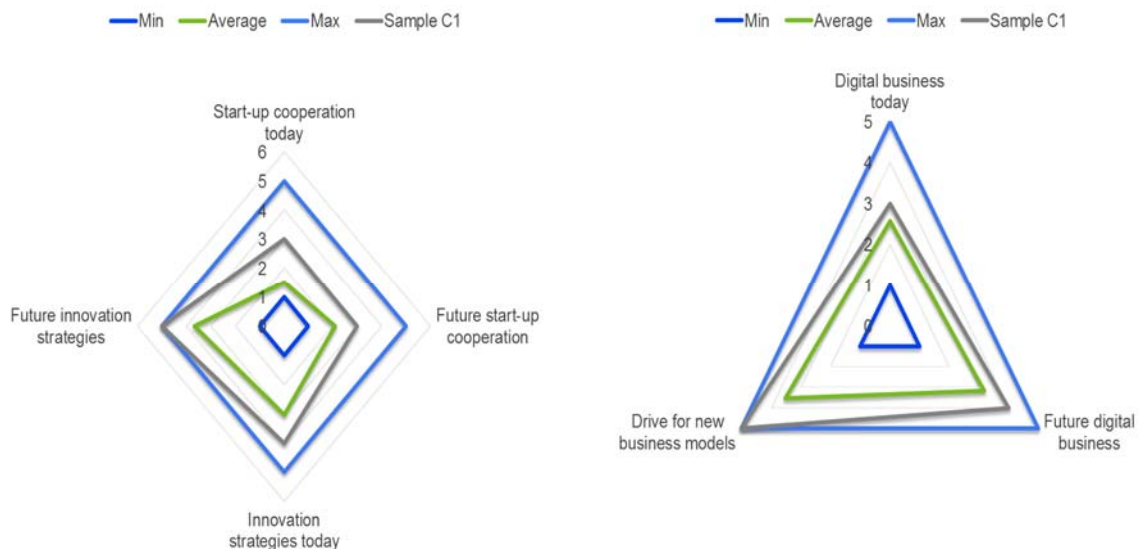


Figure 12: Detailed spider web: strategies and business models (own figure)

6 Critical reflection and future outlook

The presented results of the Digital Readiness Analysis of LSPs (DiREA) give a good impression of the actual situation as well as the future challenges of LSPs regarding the digital transformation.

Beside the quantitative results the study already had another impact. Additional interviews show that it was necessary to conduct such a study to increase the awareness for the digital

transformation. This does not only mean to become aware of it but to start or intensify the search for future opportunities and to reduce the risks for the own business models.

It was an interesting experience to see the people, who were invited to participate in the study, start looking for the “signs” of digitalization more intensively. Not only outside the own company but inside, too. This means that sometimes, especially in bigger companies, it is not known by managers what strategies and projects are already on the run in their own company.

Although, it was only a first survey, it already gives some very interesting insights. In the future the study will be addressed to LSPs nationwide as well as to some specific international players for comparison. Another possibility could be to repeat the study on a regular basis to get a clear view regarding the developments.

For the time being all participating companies who are interested in further details of the study will be invited to discuss their specific results and to commonly reflect the resulting requirements and projects for the future.

References

Angerer, Christoph (2018): Neuronale Netze – Revolution für die Wissenschaft? *Spektrum der Wissenschaft* 1.18, pp. 12-21.

Bauernhansl, T.; ten Hompel, M.; Vogel-Heuser, B. (2014): *Industrie 4.0 in Produktion, Automatisierung und Logistik – Anwendung, Technologien, Migration*. Springer Vieweg, Wiesbaden.

Borell, Nick (2016): *Das Industrie 4.0 – Arbeitsbuch*. Tredition GmbH, Hamburg.

DHL/IBM (2018): *Artificial intelligence in logistics – A collaborative report by DHL and IBM on implications and use cases for the logistics industry*. DHL Customer Solutions and Innovation, DHL CSI, Troisdorf, Germany

Goodfellow, I.; Bengio, Y.; Courville, A. (2016): *Deep Learning*. The MIT Press, Cambridge, Massachusetts, London, England

Kersten, W.; Seiter, M.; See, B. von; Hackius, N.; Maurer, T. (2017): *Trends und Strategien in Logistik und Supply Chain Management – Chancen der digitalen Transformation*. BVL Studie, Bremen, DVV Media Group GmbH, Hamburg.

Kollmann, T.; Schmidt, H. (2016): *Deutschland 4.0 – Wie die digitale Transformation gelingt*. Springer Gabler, Wiesbaden.

Nielsen, Michael (2018): ALPHA GO – Computer lernen Intuition. *Spektrum der Wissenschaft* 1.18, pp. 22-27.

SICK (2018): *Effiziente Lösungen für die Automobil- und Zulieferindustrie – Mit intelligenter Sensorik mehr erreichen*. SICK Produktkatalog Sensoren.

Ten Hompel, M.; Henke, M. (2017): *Logistik 4.0 – Ein Ausblick auf die Planung und das Management der zukünftigen Logistik vor dem Hintergrund der vierten industriellen Revolution*. In Vogel-Heuser, B., 2017, S. 247 – 257.

Vogel-Heuser, B.; Bauernhansl, T.; ten Hompel, M. (2017): *Handbuch Industrie 4.0 Band 4 – Allgemeine Grundlagen*. 2. Auflage, Springer Vieweg, Wiesbaden

Wehberg, Götz, G. (2015): *Logistik 4.0 – Komplexität managen in Theorie und Praxis*. Springer Gabler, Berlin Heidelberg

The role of information in optimising logistics processes (based on a sugar enterprise)

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Abstract: In today's world, information is considered to be a fundamental factor in building competitive advantage over other participants in a given market segment. The aim of the paper is to determine the role of information in the optimisation of logistic processes in the sugar industry. In order to analyse and respond to the research problem, historical data were collected concerning the ways of organising sugar beet transport by one of the sugar producer groups operating in Poland. The basic source of the information was the primary data provided directly by the raw material department of the selected sugar factory. The research scope covered the last 5 years in which a model for managing beet deliveries using a central delivery schedule has been introduced. The research carried out has shown that all actions taken by the sugar sector are aimed at optimising and accelerating the information flow and at using the latest communication techniques in order to reduce the workload and time needed to organise the process.

Keywords: information, delivery, information flow, feedback

1. Introduction

The sugar market is undergoing significant changes (especially after it has been freed from EU regulations). Preliminary analyses indicate that the changes taking place in this market have and will have a very significant impact on the activities of particular entities and market participants (Szajner 2017, Polowczyk and Baum 2016). At present, the three largest sugar producers in Europe (Südzucker, Nordzucker and British Sugar¹) are taking steps to adapt to the changing macroeconomic conditions. These alterations are linked to the abolition of quotas in the sugar production sector by the European Union. The supply and demand in this market, also in the global context², will be the main determinant of any changes in this sector.

¹ <http://kzpb.com.pl/produkcji-cukru-w-ue,21,pl.html> – downloaded 16.07.2017

² <http://www.cibe-europe.eu/SugarBeetSectorInsights.aspx> - downloaded 16.07.2017

One of the processes that has undergone radical transformations is the sugar beet delivery from the growers to the refineries. It takes place in several ways, of which the most important ones are:

- sugar beet growers' own-account transport,
- sugar manufacturer's transport, commissioned by a sugar beet producer.

The example of Polish sugar refineries shows that at the end of the last century deliveries made with the use of farmers' own transport dominated³. In the period of ownership transformations in the sugar industry in Poland, the process of beet purchase reorganisation began. An analysis of the available data and the authors' own observations may lead to the conclusion that currently more than 90% of beet is delivered to sugar factories by means of organised transport (transport provided by individual sugar refineries/sugar concerns within their contract areas).

In the analysed example, at the beginning of the 21st century, the quantity of beet delivered by one's own means of transport still accounted for more than 30% of all the raw material deliveries. About 10 years later, it was less than 0.2%. Such a large change in the share of own-account transport in such a short period of time indicates several issues which may be connected with the organisation of beet purchase.

The transition to transport organised completely by the sugar producer is not only connected with economic issues, e.g. improvement of transport efficiency resulting from minimising and optimising the costs of the raw material logistics. It also improves the effectiveness of the transport processes themselves, measured e.g. by the quantity of beet delivered, and is linked to optimisation of the use of the transport facilities available, and, finally, to the security of delivery continuity for the production needs of individual factories.

Increasing the capacity of individual sugar refineries, and thus the demand for the raw material, forced organisational changes in beet transport. Before the ownership transformation and the reforms in the sugar market implemented after Poland's accession to the European Union in 2004 (cf. Urban et al. 2005), there were 75 sugar factories operating in the country⁴. Currently, there are eighteen sugar refineries in operation (Fig. 1).

³ As early as in the 1995 campaign, the Pfeifer & Langen Polska Group sugar factories (11 sugar factories in the Wielkopolska region) operated 56 purchase centres where farmers delivered beets. Farmers also delivered their products directly to the sugar factories with their own transport. The low-capacity transport entailed a large number of one-off deliveries. In addition, delivery at night was impossible in such conditions, so in order to supplement the processing needs of the factories beets from purchase centres were then delivered to the sugar factories on an ongoing basis using trucks and railways.

⁴ <http://www.stc.pl/cukrownictwo.php?d=2> – downloaded 16.07.2017



Fig. 1. Map of location of sugar factories operating in Poland.
Source: <http://www.sesvanderhave.com/PL/content/mapa-cukrowni-w-polsce>

2. Research assumptions, design and scope

The aim of the paper is to determine the importance of information in the optimisation of logistic processes in the sugar industry. The question about the role of information in logistic processes is particularly important in the case of deliveries of the raw material to refineries from dispersed suppliers - small growers.

An analysis of the data received from one of the sugar concerns operating in Poland contributed to the proposal of several theses related to information, its role in logistics processes, its circulation and use at various stages of beet delivery in control and optimisation processes. The most important preliminary statements related to the role of information in logistics processes indicate that the following are taking place:

- limitation of the human factor participation,
- limited use of information carriers,
- limitation of human labour in planning,
- quick access to current data.

The above claims concerning the logistics processes in general can directly refer to the sugar beet delivery process (all the elements listed are taken into account). Changes in the share of human labour and factor in the organisation and fulfilment of deliveries are particularly visible, e.g. in the number of drivers.

In order to solve the research problem connected with the role of information in the process of beet delivery, one of the heuristic research methods (counted among intuitive methods and applied in qualitative research and forecasting economic phenomena), namely the case study method, was used. It is a research method based on simultaneous application of many methods in order to diagnose a given fragment of reality as accurately as possible. In a case study, a researcher tries to describe a certain group or individual in a comprehensive way,

taking into account a rich set of variables and correlations between them. This method is recommended for testing information systems in enterprises (Stańko 1994, Kuciński 2007).

As the observations and studies were based on real data (from one of the sugar enterprises) and intended to be interpreted further in detail, the research method used was based on a detailed monographic analysis of the data collected. The time scope of the research was 2012-16.

The article fits into a research trend which analyses the mechanisms behind the practical benefits from using IT instruments in supply chain management (cf. Auramo et al. 2005, Prajogo and Olhager 2012).

3. The role of information in optimising logistics processes - emerging research problems

The logistics of sugar beet deliveries for processing can be defined as the processes involved in planning, fulfilling and controlling an efficient and effective flow of sugar beet between the farmer's plantation and the sugar factory, including the flow of the necessary information, too (Abt 1998, p. 30).

In order to properly determine the effectiveness of the changes introduced to the organisational model, it is necessary to assess the changes at both the material and non-material level (Krawczyk 2001, p. 34-42). Although the changes are naturally understood to be economic and financial, it is also important to consider other categories that are more intangible, such as moral, social and environmental values. These are exactly the last ones among which the optimisation of logistics processes in terms of information flow should be enumerated.

Emphasising only changes in the usage of the means of production per unit of the product, e.g. by increasing work efficiency and effectiveness of the use of transport means, will at some point lead to reaching the limit of further effective investment in changes. The element that can push this boundary is information.

In terms of the efficiency of the logistics processes, the following can be distinguished:

- primary information related to plans, schedules and other assumptions concerning the course of the given process,
- secondary information related to changes in logistic processes within the scope of their deviations from the assumed limits, appearing in opportunities and threats.

Ubiquitous information and accumulation, processing and analysis/interpretation thereof entail a need to build an appropriate infrastructure of not only dedicated computer programs supporting information handling, but also specialised integrated systems such as:

- SCM - supply chain management,
- WMS - warehouse process management,
- ERP - enterprise resource planning.

The character of the transport of agricultural produce, in particular sugar beet, delivered directly for processing from the growers' fields, makes it important to prepare an appropriate infrastructure enabling a free flow of information among the individual participants. It should be noted here that the participants of the processes are often entities cooperating only during the sugar season and the infrastructure used in the process must not be an additional cost burden for them.

4. Organisation of raw material deliveries to sugar factories - changes and present state of information in the process

Only 20 years ago, most sugar beet deliveries were made by and with direct involvement of the farmers themselves. The main means of transport were agricultural tractors with trailers. The average weight of the beets delivered in this way was about 8 tonnes of clean beets per single shipment⁵. Assuming that in the 1990s the average daily beet throughput at a sugar factory was around 2,800 tonnes⁶, approximately 350 deliveries per day were needed to meet the processing needs.

The organisational changes related to the sugar industry privatisation in Poland along with the reorganisation of the sugar market in the European Union resulted in a drop in the number of sugar refineries in operation to about a dozen (cf. Fig. 1). The average daily beet throughput at each of these sugar factories more than doubled to around 6,200 tonnes⁷ in 2013. It contributed directly to an active search for new solutions and to reorganisation of the sugar beet deliveries to individual sugar factories. Meeting the processing needs of roughly 6 thousand tonnes per day with the use of farmers' individual transport would require daily service of 500 to 700 transport sets (and the same amount of delivery weighing).

Handling such a number of events (raw material deliveries to factories), assuming transport supposed to satisfy the processing needs (without taking into account the buffer and rotating stocks) of individual refineries, would mean the emergence of many sensitive places and moments in the supply chain, where the information flow could be jeopardised. Such disruptions would result in deterioration of the economic effects of the sugar enterprise or its co-operators.

Organising the beet collection process conducted with such inefficiencies in the transport would involve:

- introduction of a detailed schedule of the beet deliveries for the processing needs of the given sugar factory, taking account of the large number of carriers, low-capacity vehicles and the use of different transport and unloading technologies,
- continuous updating and verification of the delivery schedule, which would be troublesome or impossible due to the number of the independent participants,

⁵ clean beets are beets without organic debris, i.e. residues of leaves, weeds, heads or soil and stones

⁶ <http://stc.pl/cukrownictwo2.php?d=3> – downloaded 16.07.2017

⁷ <http://kzpsc.com.pl/wyniki-produkcyjne-w-polsce,50,pl.html> – downloaded 16.07.2017

- introduction of a well-developed technical infrastructure at sugar factories related to: waiting yards, scales, places and methods of unloading, taking into consideration a direct way of handing over the beets for processing and the need for additional cleaning of the beets on the factory premises as well as the management of the debris/waste (farmers do not have their own beet cleaning machines).

Realising the above proposals would require major investments in technical, infrastructural and organisational solutions aimed at improving the organisation of taking a large number of deliveries per time unit and of a correct information flow among the different beet delivery participants.

The introduction of transport organised by the sugar manufacturer using heavy goods trucks has allowed to reduce the number of single shipments. The achieved reduction in the number of individual shipments amounted to about 60% in relation to the number of shipments carried out directly by individual farmers using their own means of transport.

The transport organisation taken over by sugar factories has caused it to be conducted by specialised transport groups with appropriate, unified transport equipment adapted to the technical needs of sugar factories (e.g. the unloading method). Such an action has meant that:

- only a few transport groups are managed, which facilitates the preparation of delivery schedules and verification of their realisation,
- the flow of important information among the different actors in the process is accelerated,
- the technical infrastructure in the sugar factory of a given sugar manufacturer is reduced and unified,
- the impact of the individual (the farmer who delivers beet to the sugar refinery themselves) on the beet delivery process is limited - the driver from the transport group is involved in the process throughout the beet campaign.

5. Efficiency of raw material delivery logistics to sugar factories in terms of information flow

Changes in the logistics of raw material deliveries to processing plants are also related to changes in the information flow processes. The most important ones include the following:

- optimisation of the number of participants in the logistics processes (analysis of the use of lorries expressed in daily working hours and, in the case of cleaning machines, the amount of beet loaded during the whole campaign),
- delivery optimisation in terms of taking advantage of the full processing capacity of the factories,
- shortening the time of beet flow from fields to the factories (reducing the number of days between harvest and delivery),
- acceleration of the information flow among the process participants (shortening the time needed to notify the process participants about the changes occurring at particular stages of the supply chain),

- information feedback within the process,
- automation of the identification processes of the individual process participants and processing sites.

A good example of the lack of optimisation in the information flow process within the supply chain is the relationship between the level of daily sugar beet deliveries and the throughput of the given factory. Even the best production plans and schedules cannot predict disturbances caused by factory failures or events happening on the road or in the field in the course of the beet delivery. As shown in Figure 2, there are times when the lack of coordination and information flow causes the beet deliveries to exceed the processing needs of the factory. At such a moment, the stock is artificially increased, which is, in turn, associated with rising operational costs resulting from, for example, losses of sugar in the stored beet.

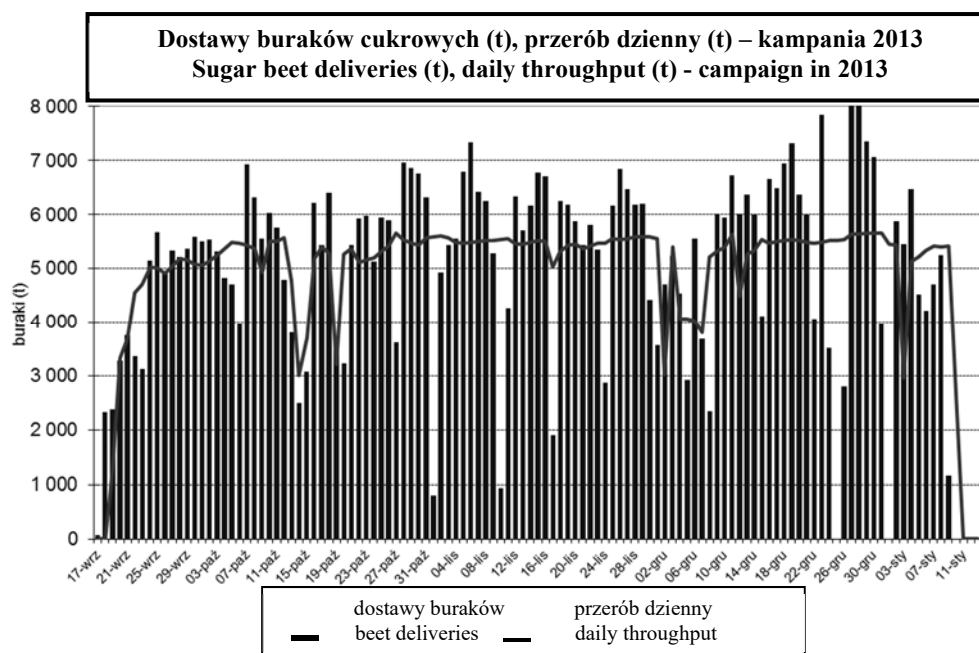


Fig. 2. Comparison of beet delivery size and their daily throughput at sugar factory
 Source: own study based on data from 2013 campaign

A faster and complete transfer of information between the participants in the process in the event of a failure at the sugar factory will result in a reduction in the stocks and better use of the means of transport. A carrier receiving up-to-date information is able to organise the work of the transport group in such a way that the cars not needed at a given moment are diverted to some other work or excluded from the activity as part of the mandatory breaks in the driver's work.

The role of information cannot be overestimated in proper realisation of plans and assumptions, either. Figure 3 presents the level of the delivery plans and fulfilment thereof. Wherever increased deviations of the fulfilment rate from the plans are observed, it shall be

assumed that access to complete and faster flowing information would reduce the abovementioned differences.

Another discriminant of the improvement in the processing plan realisation in the arrangement of the beet delivery is the time that the vehicles wait for unloading at the sugar factory yard. In this case, the rate has improved by 42% (while in 2012-2015 the average waiting time for a vehicle to be unloaded was 48 minutes, in 2016 it was only 28 minutes). The reduction of this rate was possible thanks to the use of the detailed beet delivery plan in the organisation of the carriers' work. The plans were based on individual beet heaps formed by farmers on their own plantations. In addition, an index was introduced determining the expected actual beet yield from a given plantation, which made the quantities of beets planned to be delivered real in relation to the contract plans.

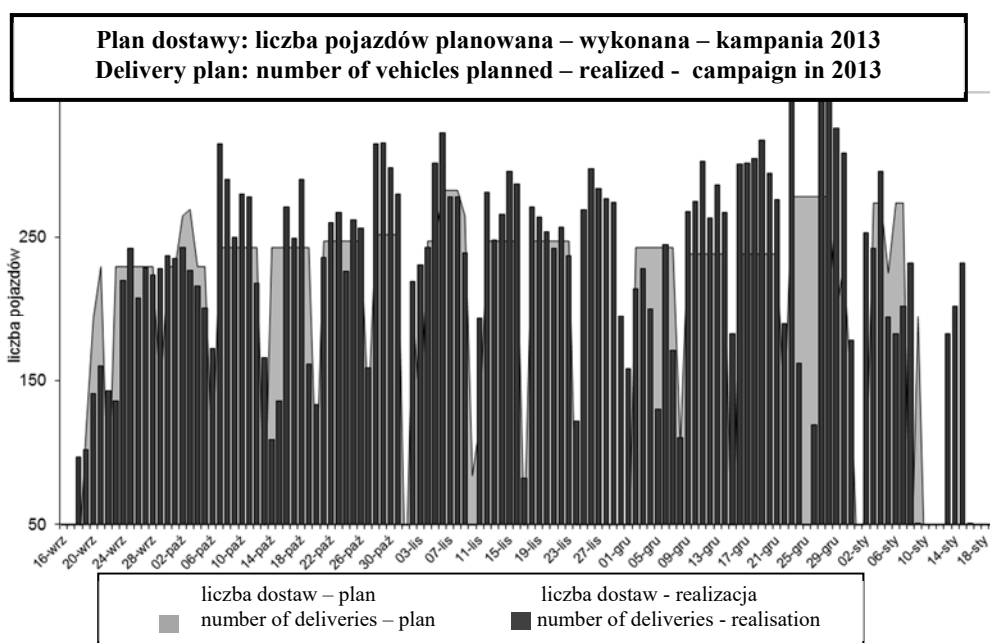


Fig. 3. Planned and realised beet delivery to the sugar factory
 Source: own study based on data from 2013 campaign

The application of the abovementioned solutions indicates that the character of the organisation and logistics of the raw material deliveries to the sugar refineries requires a systemic approach. The implementation of the idea of a holistic approach results from the multidimensionality of the issue discussed (technical, technological, economic determinants, etc.). According to this concept, the organisation of the beet delivery process may be perceived as a system (a network, to be more precise) in which information and resources are exchanged. The information relayed by the employees and the individual subsystems, i.e. raw material, technical, production, storage and packing departments of the sugar factories, is intended to lead to the performance of the assumed tasks. The different parts of this system are (and must be) closely connected (Stabryła 2006, p. 218).

The holistic approach (with a simultaneous detailed approach within the individual processes) will allow to build an optimal and economically justified model of action for sugar beet

deliveries for direct processing at sugar factories. The recommendations for the enterprises assume that the structure and function of the organisation and logistics of the raw material deliveries will be shaped in such a way so as to achieve a maximum synergistic effect with simultaneous high economic efficiency of the processes (Grontkowska and Klepacki 2006, p. 56).

Research conducted by other authors (Auramo et al. 2005, Wong et al. 2009, Prajogo and Olhager 2012) shows that accelerating the flow of information with the use of the latest information technologies has many advantages and brings measurable benefits to companies - first of all, it improves the quality of information and thus customer service, allows to increase productivity, which enables staff to focus on critical business activities; finally, these solutions support process planning (but also redesigning) and improve the supply chain efficiency.

Information also enables the supply chain to be better integrated with the enterprise's resource planning, which makes it possible for the company to continuously build more effective processes through greater benefits from the relationships with suppliers (Koh et al. 2006).

Attention is also drawn to the role of information in making the supply chain more flexible and in understanding the complexity of its competences (Ngai et al. 2010).

6. Summary

In order to achieve the optimisation objectives in the logistic processes at sugar factories, in particular the detailed examination and improvement of the delivery efficiency, it is necessary to implement procedures consistent with the presented assumptions, which focus on:

1. elimination of factors generating errors, particularly the human factor. This can be achieved by: reducing the impact of decisions made by people participating in the beet delivery process (e.g. reacting to emerging deviations from the assumptions); reducing the amount of documentation, especially in paper form. Another element increasing the correctness of the undertaken actions is making appropriate information available to the participants of the process, e.g. information related to the plans and schedules of deliveries to be carried out by the growers and carriers.
2. optimisation of the working time of beet harvesters and the harvesting dates, which translates directly into a reduction of the losses resulting from storing beets in the field. In addition, the utilisation rate of a given machine/combine harvester in its short operating season will improve.
3. optimising the performance of the heavy goods vehicle fleet used to transport beets and of its drivers, particularly when beets need to be delivered for processing 7 days a week, 24 hours a day.
4. in order to achieve the objectives (and further improve the efficiency of the whole process), it is advisable to add extra information to the existing chain. An example may

be giving products transported to the farmers from the sugar factories, such as beet pulp and defecation lime. Optimisation in this area will help to reduce costs and, at the same time, boost the growers' satisfaction with the service.

5. introducing a hierarchy of importance in the information relayed to the actors in the chain and the way of relaying it. Experience shows that an excess of information is more harmful in processes than a shortage thereof (Korczyk J. 2013, p. 111-127). An excess of information can cause:

- information overload,
- dividing information into individual categories according to its importance.

When information is relayed, the most important thing, apart from how fast it reaches the right recipient, is its transparency and generation of the appropriate effect. In particular, frequently updated and completed information may have the opposite effect to the expected one. What becomes important here are the following:

- the way of relaying information, i.e. selection of an appropriate communication channel
- the information content.

6. the use of the latest technologies in the process of communication and information transmission. It is important for the information to reach the place where it is needed and produce the assumed effect. For example, sending information about a failure at the sugar factory to the head of the transport company will not have the expected effect due to the extended time of the transfer thereof to the place where it is necessary, i.e. to the lorry drivers and loading machine operators. Sending this information to the drivers and operators at the same time will trigger an immediate and expected reaction related to limiting or stopping the delivery of the raw material for processing.

Bibliography

Abt, S. (1998), *Zarządzanie logistyczne w przedsiębiorstwie*. Warszawa: PWE, 30.

Auramo, J., Kauremaa, J., & Tanskanen, K. (2005). Benefits of IT supply chain management: an explorative study of progressive companies. *International Journal of Physical Distribution & Logistics Management*, 35(2): 82-100.

Grontkowska, A., Klepacki, B. (2006), *Ekonomika i zarządzanie przedsiębiorstwem w agrobiznesie*. Warszawa: Format AB, 56.

International Confederation of European Beet Growers (2017). Pobrano 16.07.2017 z: <http://www.cibe-europe.eu/SugarBeetSectorInsights.aspx>

Koh, S.C.L., Saad, S.M., Arunachalam, S. (2006). Competing in the 21st century supply chain through supply chain management and enterprise resource planning integration. *International Journal of Physical Distribution and Logistics Management*, 36: 455-465.

Krajowy Związek Plantatorów Buraka Cukrowego (2017). Pobrano 16.07.2017 z: <http://kzpbcc.com.pl/produccenci-cukru-w-ue,21,pl.html>

Korczak J (2013), *Inżynieria procesów logistycznych*. Bydgoszcz: Wydawnictwo Uczelniane Wyższej Szkoły Gospodarki w Bydgoszczy, 111-127.

Krawczyk, S. (2001), *Zarządzanie procesami logistycznymi*. Warszawa: PWE, 34-42.

Kuciński, K. (red.) (2007) *Doktoranci o metodologii nauk ekonomicznych*. Warszawa: SGH.

Ngai, E.W.T., Chau, D.C.K., and Chan, T.L.A. (2010). Information technology, operational, and management competencies for supply chain agility: Findings from case study. *Journal of Strategic Information System*. 20 (3) 2011: 232-249.

Polowczyk M., Baum R. (2016), Changes in the organization and logistics of supplies in sugar factories (methodological assumptions for the study of effectiveness). *J. Agribus. Rural Dev.* 4(42) 2016: 619-627.

Prajogo, D. & Olhager, J. (2012), Supply chain integration and performance: The effects of longterm relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics*, 135(1): 514-522.

Sesvanderhave N.V. (2016), Pobrano 12.08.2016 z: <http://www.sesvanderhave.com/PL/content/mapa-cukrowni-w-polsce>

Stabryła, A. (2006). *Zarządzanie projektami ekonomicznymi i organizacyjnymi*. Warszawa: PWN, 218.

Stańko, S. (1994). *Prognozowanie w rolnictwie*. Warszawa: SGGW.

Stowarzyszenie Techników Cukrowników (2017). Pobrano 16.07.2017 z: <http://www.stc.pl/cukrownictwo.php?d=2>

Szajner P. (2017), *Rynek cukru stan i perspektywy*. Warszawa IERiGŻ.

Wong, C. W., Lai, K.-H. & Ngai, E. W. (2009). The role of supplier operational adaptation on the performance of IT- enabled transport logistics under environmental uncertainty. *International Journal of Production Economics*, Vol. 122: 47-55.

Teaching and Learning in the Knowledge Economy

Adriana Schiopoiu Burlea

This stream includes both conceptual and empirical contributions on topics related to teaching and learning in the knowledge economy: the teaching and learning paradigms; education, globalisation and knowledge economy; theory and practice of online learning; the use of technology in university teaching and learning; lifelong learning and the knowledge economy; practical approaches to teaching and learning; innovation management learning in the knowledge economy.

The Evaluation of the Learning Process in Romanian Innovative Small and Medium Enterprises

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Abstract: The article aims to evaluate the effects of the learning process in Romanian Small and Medium Enterprises (SMEs) at two levels. First, we have analyzed the SME's learning process as an intrinsic motivational factor for the employees and then we analyzed the SME's learning process as a profit source for the enterprise. We have employed three variables in our research: the learning process, the variance of the number of employees and the enterprise's profit, using a quantitative approach to measure the relationship between them. The results will highlight the direct relationship between the learning process in SME's and their employees number variance as well as the positive relationship between the profit of innovative SME's and their employees' learning process. The learning process is an important factor for the innovative SME's as a source for the human resources' development. The effects that the learning process has upon the innovation of products and processes in SME's. This suggest that when the employees are engaged in learning behaviors, the innovative SME's environment seems more attractive to them.

Keywords: innovation, learning process, small and medium enterprise, performance

1 Introduction

Small and medium-sized enterprises (SMEs) increasingly face a challenging external environment because of rapid technological evolution, globalization, and increasingly sophisticated competitors (Brettel and Rottenberger 2013). In this dynamic environment, small businesses need the ability to identify and pursue opportunities by adapting to this dynamic environment well ahead of their competitors, despite the limited resources they have as a result of their size (Shane and Venkataraman 2000; Zahra and Garvis 2000). In this context, interest in the relationship between the learning process and the organizational performance and innovation has escalated over the past two decades, because both provide possible ways to address the need to encourage and manage strategic change continuously in order to achieve competitive advantage (Covin and Slevin 1989), ensure survival, and generate enhanced performance (Wiklund and Shepherd 2005; Brettel and Rottenberger 2013).

The changing nature of work and the dynamic reality of organizations have challenged the traditional view of employees' performance. Given that competitiveness, rapid innovation,

and continuous change have come to dominate the current market, the focus has shifted from employees' proficiency to their ability to adapt to new organizational challenges (Griffin et al. 2007). The constantly changing environment and fast-paced nature of modern work are also challenging the classical view of the employee–organization relationship, particularly regarding the level of activity expected from employees (Frese 2008) and the need to achieve more with less (Masson et al. 2008, Eldor and Harpaz 2016). As a result, the concept of employee engagement, characterized by high energy and deep dedication, has been introduced into the literature as a potentially optimal means of redefining the employee–organization relationship (Bakker et al. 2011; Vigoda-Gadot et al. 2013, Eldor and Harpaz 2016).

However, although in recent decades scholars have made great strides in developing the concept of the learning process, scientific studies on its implications for job attitudes and performance are relatively lacking. Its advocates argue that a learning process should enhance employees' attitudes and performance (Ellinger et al. 2002; Jashapara 2003; Joo and Lim 2009; Yang et al. 2004). While these arguments are largely descriptive and grounded in practice, they still provide growing evidence of the potential relationship between perceived learning climate and employee engagement. Note that in the current study the concept of the learning process is used as predictor to an increase in the innovation and performance levels of the organization and reflects employees' perceptions of the degree to which the atmosphere in the organization encourages learning. We have chosen to focus on their subjective perspective because our goal was to understand how employees' interpretation of their contextual environment influences their job attitudes and work performance.

The changing nature of work has challenged the traditional views of fixed, in-role performance, which no longer accounts for the full range of behaviors needed today (Ilgen & Pulakos 1999). Competitiveness, rapid innovation, and continuous change dominate the current market. Organizations are therefore looking for specific competencies and extra-role behaviors in employees that facilitate adaptation to new organizational requirements and contribute to the need for effectiveness in the dynamic contemporary organizational reality (Griffin et al. 2007). Accordingly, our focus here is on these essential behaviors—proactivity, knowledge sharing, creativity, and adaptivity—with the goal of determining whether employee engagement promotes them. Proactivity represents self-initiated and future-oriented performance that seeks to change either the situation or oneself (Grant and Ashford, 2008; Griffin et al., 2007). Knowledge sharing reflects a process whereby individuals exchange their tacit and explicit knowledge to create new organizational knowledge (Inkpen and Tsang 2005; Van den Hooff and De Ridder 2004). Creativity means the production of new and useful ideas and fuels innovation in products, services, processes, and procedures in organizations (Amabile 1996; Zhou and Shalley 2008). Finally, adaptivity refers to employees' ability to respond constructively to new and unexpected circumstances (Pulakos et al. 2000).

Our paper aims to evaluate the effects of the learning process upon 200 Romanian employees, in relationship with the organizational performance and innovation. First, we have analyzed the SME's learning process as an intrinsic motivational factor for the employees and then we analyzed the SME's learning process as a profit source for the enterprise. The results will

highlight the direct relationship between the learning process in SME's and their employees number variance as well as the positive relationship between the profit of innovative SME's and their employees' learning process.

2 States of the art

2.1 Learning process in small and medium enterprises

The field of learning process has gained increased attention recently, resulting in a broadened concept of organizational learning (Bapuji et al. 2005; Burlea Schiopoiu 2008, Easterby-Smith and Lyles 2003). In their literature review, Wang and Ahmed (2002) identify five focus areas for the learning process in the literature: collectivity of individual learning, culture or metaphor, knowledge management, continuous improvement, and process or system. The focus on collectivity of individual learning, or the process of how organizations learn, has determined the theoretical and empirical work on the learning process in the management literature, and there is growing consensus that the learning process unfolds in the four general learning processes (Lawrence et al. 2005; Nonaka 1994) that lie at the core of Crossan, Lane, and White's (1999) 4I organizational learning framework: Intuiting, Interpreting, Integrating, and Institutionalizing. According to Crossan et al. (1999, p. 25): (1) Intuiting is the preconscious recognition of the pattern and/or possibilities inherent in a personal stream of experience. This process can affect the intuitive individual's behavior, but it only affects others as they attempt to (inter)act with that individual. (2) Interpreting is the explaining [. . .] of an insight or idea to one's self and to others. This process goes from the preverbal to the verbal and requires the development of language. (3) Integrating is the process of developing shared understanding amongst individuals and the taking of coordinated action through mutual adjustment. Dialogue and joint action are crucial to the development of shared understanding. This process will initially be ad hoc and informal, but if the coordinated action-taking is recurring and significant, it will be institutionalized. (4) Institutionalizing is the process of ensuring that routinized actions occur. Tasks are defined, actions specified, and organizational mechanisms put in place to ensure that certain actions occur. Institutionalizing is the process of embedding learning that has occurred by individuals and groups into the institutions of the organization, and it includes systems, structures, procedures, and strategy (Brettel and Rottenberger 2013).

The learning process is a concept with a long history of research, the main focus being the role of the experience in the learning process. Some scholars argued that experience is all that is needed for learning to occur (Beckman and Barry 2007), others, such as Dewey, proposed that learning is an ongoing "reconstruction of experience" that reconciles new experiences with old ones in a continuous learning process (Dewey 1997). In 1984, Kolb pulled from these many theories of learning to build what he called "experiential learning theory" in which he defined learning as "the process whereby knowledge is created through the transformation of experience," (Kolb 1994, p.41) and he defined the learning process as applying the four steps of experiencing, reflecting, thinking, and acting in a highly iterative fashion (Zull 2005).

Recent studies on employee training have confirmed that there is a significant gap between how the learning process is conducted in SME's and large companies. The learning process happens substantially slower in small than in larger firms across all countries in Europe. Small businesses face considerable obstacles to providing the employees with an adequate learning process. Identifying the major obstacles that SME's face when dealing with the learning process, would enable the identification of appropriate policies needed to develop the learning process among small firms (Majovski 2017).

The issue of SMEs investing significantly less in the employee's learning process as opposed to large firms has raised the interest among researchers in recent years. As SMEs account for more than 99.8% of companies in Europe, the vast majority of them being micro businesses, their learning process, i.e. the extent and quality, is an important determinant of the overall training levels in the economy as well. Yet, studies have found considerable difference in training provision between small and large firms. In particular, in the OECD countries, SMEs provide 50% less training to employees as opposed to large firms. In particular, the Scandinavian countries show considerably higher participation than Southern European countries (Majovsk 2017). Moreover, empirical studies reveal that training participation levels differ significantly among countries in Europe (Ok and Tergeist 2003).

The main objective of the learning process is to improve human capital and thus increase the productivity of firms and the overall competitiveness of the economy, generating benefits for individuals, firms and society. In this context, investments in human capital have been considered essential to sustainable economic growth. Yet, due to various forms of market imperfections and internal obstacles of training, firms invest insufficiently in training of their workforce. Namely, about one third of the firms in EU did not provide any training to employees. Such trend has been evident in the past decade as well (EIM/SEOR, 2005). Nevertheless, the rapid pace of technological improvements and more sophisticated production processes impose higher demand for employee training as skills become obsolete more quickly than ever before. Thus, workforce upskilling is especially important in small firms not only because they are said to constitute the backbone of every economy but also because small firms face increased obstacles to training in comparison to larger firms (Majovski 2017).

Beckman and Barry (2007) state that individual preferences for learning styles are thought to be derived from their personality type, educational specialization, professional career, current jobs, and the specific task or problem the person is working on at present. Importantly, the learning style is not a fixed trait in an individual, but "arises from consistent patterns of transaction between the individual and his or her environment.... people create themselves through the choice of actual occasions they live through." (Kolb 1984, pp. 63-64) This notion of adaptability is critical to the implementation of the innovation process model. It suggests that companies wishing to become more innovative can indeed create environments and situations that cause their employees to engage in doing so.

Learning how to build stronger relationships with customers is often recommended as a way of ensuring the survival of firms in the face of turbulent and/or highly competitive market conditions (Webster 1992). In commenting upon this scenario, de Gues (1988) has suggested that in situations where products and processes can be rapidly copied, the only real source of

competitive advantage is to stimulate learning by employees. This may assist these individuals to identify new ways of working more closely with customers, which in turn permits the organization to differentiate itself from competition (Chaston et al. 2001)

Bell (1973) had proposed that the information and knowledge acquired by employees is now more important than the more traditional assumption that the technology contained within the firm's capital assets can provide the basis for delivering product superiority over competition.

In proposing employee-initiated strategic responses to changing market conditions, most authors have justified their opinions by drawing upon the learning process literature. The origins and theoretical foundations of organizational learning can be traced back to the work of Cyert and March (1963), Bateson (1972), March and Olsen (1976) and Argyris and Schon (1978). Over the last few years the literature on this topic has grown very rapidly, attracting interest from a diverse variety of academic perspectives. Easterby-Smith (1997) in his review of the theoretical roots from which the subject has evolved, suggests that contributions have been made from the fields of psychology, organizational development, management science, strategic management, production management, sociology and social anthropology.

In view of the widely expressed support for the benefits offered by the learning process, it is perhaps somewhat surprising, therefore, to find that limited empirical evidence exists in the academic literature validating the actual impact on organizations (Burlea Schiopoiu 2009; Chaston et al. 2001). Easterby-Smith, for example, (1997, p. 1109) in commenting on this situation noted that "much of the existing research is based on case studies of organizations that are said to be successful, and these sometimes seem to rely more on public relations than on any rigorous and grounded studies." His view supports an earlier analysis by Huber (1991) which also concluded that there is (1) little in the way of substantial theory concerning organizational learning in relation to impact on firms, and (2) minimal cross-fertilization between research groups from different academic traditions.

The innovation process is grounded in deep understanding of the context of engagement and use of a solution through the concrete analytical work done in observation (Beckman and Barry 2007). Thorough understanding of customer and user needs is generated through observational or ethnographic research that seeks to understand not only the fundamental use and usability needs of the customer or user, but also the meaning-based need (Hy and Mariampolski 1999). This understanding may well be supplemented by quantitative market research, but such research must be guided by the understanding developed through direct interaction with customers and users (Beckman and Barry 2007).

The literature serve as a basis for our first hypothesis:

Hypothesis 1: There is a positive relationship between the employees' learning process and the profit in SME's

2.2 The concept of innovation

Among empirical studies of organizational adoption of innovations, nearly all either focus on the diffusion of innovations within one or more organizations (Walker 1969; Romeo 1975;

Rapoport 1978; Felier and Menzel 1978; Levine 1980), or they probe the association between a measure of organizational innovativeness and various organizational variables (Evan and Black 1967; Rosner 1968; Mohr 1969; Aiken and Hage 1971; Kaluzny et al. 1974; Baldrige and Burnham, 1975). Very few have explored the relationship between the organizational learning process and the company's performance.

Innovation is a widely used concept and the term is variously defined to reflect the particular requirements and characteristics of a specific study. In this investigation, innovations were considered to be responses to environmental change or means of bringing about change in an organization. Organizations can cope with environmental changes and uncertainties not only by applying new technology, but also by successfully integrating technical or administrative changes into their organizational structure that improve the level of achievement of their goals (Rosner, 1968). Innovations at the organizational level may involve the implementation of a new technical idea or a new administrative idea. The adoption of a new idea in an organization, regardless of the time of its adoption in the related organizational population, is expected to result in an organizational change that might affect the performance of that organization (Damanpour and Evan, 1984). Therefore, an idea is considered new in relation to the adopting organization, not in relation to its organizational population.

From a systems perspective, performance is the ability of an organization to cope with all four systemic processes (inputs, outputs, transformations, and feedback effects) relative to its goal seeking behavior (Evan 1976). A high-performing organization would accomplish its primary tasks efficiently and would carry out its organization-maintaining and organization-adapting functions effectively (Mites, 1980). The organization-adapting function requires that as the environment changes, the structure or processes of the organization undergo change to meet the new environmental conditions. Innovative organizations tend to do more. They not only adapt to the environmental change, but also use their resources and skills to create new environmental conditions, e.g., by introducing new products or services never offered previously. Innovations are means of providing these internal or external changes and are, therefore, a means of maintaining or improving organizational performance (Damanpour and Evan 1984).

A few empirical studies reported positive effects of innovation on performance. For example, Mansfield (1968) reported that innovators in the steel and petroleum industries grew more rapidly than other firms in those industries during the five to ten years after the innovation. Armour and Teece (1978) found that the adoption of a major administrative innovation (the multidivisional structure) in petroleum firms increased the rate of return on owners' equity. Mahoney and Weitzel (1969) suggested that innovation, along with productivity, planning, and reliability, appeared to be an independent criterion of organizational performance. No empirical research, however, has thus far been undertaken to test the differential impact of administrative and technical innovations on performance (Damanpour and Evan 1984).

Thus we propose the following hypothesis:

Hypothesis 2: There is a positive relationship between the employees' learning process and the innovation of products and processes in SME's

3 Research methodology

As we have stated before, the main purpose of our paper is to analyze the relationship between the learning process and the organizational innovation on one hand and the organization's performance, on the other hand. In order to fulfill this purpose, we have set the above research hypotheses.

In order to test these hypothesis, we have used a survey with 17 questions. The 17 questions were divided into three parts: Part 1 – general information regarding the respondent; Part 2 – motivation related questions and Part 3 – learning process related questions. Besides these questions, we have also used performance related variables such as “profit”, “employees’ number”, “profit per employee” and “R&D expenses”, data which is publicly available in the company's balance sheet.

The survey was a conducted on a sample of 200 employees, from three constructions small or medium enterprises from Craiova, Romania: a micro enterprise with 9 employees (8 of them participated in this study), a small business with 44 employees (40 of them responded to our request to participate in this study) and a medium company with 249 employees (152 were included in this study). Most of the employees are low level workers, some of them might be low level team leader or middle management at most. We have not included any top level executive or the owners of these companies in our study in order to keep the answers honest and relevant to our objective and hypothesis.

In the results' discussion we will use the following codes for our variables:

- Q1 - I consider that trainings are an efficient way to motivate my self
- Q2 - I consider that trainings are an efficient way to increase my performance
- Q3 - I consider that trainings are an efficient way to make me more responsible and loyal
- Q4 - Usually, the trainings that I attend are paid by my company
- Q5 - I consider that I am more efficient and productive after I attend a company sponsored training
- Q6 - I consider it is my responsibility to motivate myself by attending trainings
- Q7 - We are encouraged to participate in trainings, outside the ones offered by my company
- Q8 - I usually have the chance to choose which trainings to attend
- Q9 - I fill in, on a regular basis, a needs assessment form, in order to identify what kind of training I need
- Q10 - My performance is evaluated by a set of commonly agreed standards
- Q11 - The learning process is important for the development of my career

4 Findings and discussion

Table 1 provides summary statistics (mean and standard deviation) and Pearson correlations for the variables used to analyze the employees' learning process.

Table 1. Descriptive statistic and correlation for analyze the employees' learning process

Items	Mean	Std. Deviation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Q1	3,385	1,045	1	,062	,093	,159	,037	,076	,095	,019	,204	,278	,027
Q2	3,460	1,202	,062	1	,114	,085	,101	,027	,033	,037	,124	,074	,010
Q3	3,310	1,082	,093	,114	1	,196	,014	,100	,133	,077	,052	,076	,026
Q4	2,740	1,085	,159	,085	,196	1	,108	,131	,108	,042	,234	,029	,142
Q5	3,675	1,037	,037	,101	,014	,108	1	,112	,222	,008	,044	,006	,003
Q6	3,085	1,106	,076	,027	,100	,131	,112	1	,094	,111	,197	,001	,280
Q7	2,800	1,093	,095	,033	,133	,108	,222	,094	1	,043	,132	,171	,012
Q8	3,065	1,027	,019	,037	,077	,042	,008	,111	,043	1	,045	,111	,017
Q9	3,360	1,084	,278	,074	,076	,029	,006	,001	,171	,111	,065	1	,070
Q10	3,555	1,210	,204	,124	,052	,234	,044	,197	,132	,045	1	,065	,090
Q11	3,820	1,055	,027	,010	,026	,142	,003	,280	,012	,017	,090	,070	1

Table 1 shows us that the values for the standard deviation are close to each other and vary between 1,027 and 1,210. Thus, the lowest standard deviation has been registered for Q8 (1,027) which proves that the freedom to choose which trainings to attend is very important to the employees. The highest standard deviation has been registered at Q10 (1,210) which proves that the evaluation process is a sensitive process in the SME's, while the employees have different opinions regarding the way their performance should be evaluated.

The inter-item correlation shows that the weakest correlation is registered between Q6 and Q9 (.001), which proves that even if the employees consider that is their responsibility to motivate themselves by attending trainings, they have to fill out needs assessment forms on a regular basis in order to identify their training needs. The strongest correlation can be observed between Q6 and Q11 (.280), a fact which proves Maslow's (1970) motivational theory according to which the learning process is a factor which can initiate a pluralistic behavior and the employees consider the learning process to be their responsibility and at the same time, a motivational factor for developing their career, because their needs act on different levels simultaneously (Burlea Schiopoiu and Remme 2017; Tay and Diener 2011)

Another strong correlation can be observed between Q1 and Q8 (,278) which shows us that the learning process remains an efficient motivational factor for the employees even if they have to choose their trainings on a regular basis.

We used a regression to test the effects of employees' learning process on profit in SME's; and the results reveal that, consistent with prior research (Burlea Schiopoiu and Burdescu 2016; Eldor and Harpaz 2016), employees' learning process was likely to be relatively high when profit was high ($\beta = 0.41, p < 0.001$).

We also used a regression to test the effects of employees' learning process on innovation of products and processes in SME's; and the results reveal that, consistent with prior research (Beckman and Barry, 2007s), employees' learning process was likely to be relatively high when R&D expenses were high ($\beta = 0.43, p < 0.001$).

Table 2. Inter-Item Correlation Matrix

	Employee's education level	Number of employees	Company's profit	Profit per employee	R&D expenses	Employee's learning process
Employee's education level	1,000	,993	,955	,997	,997	-,770
Number of employees	,993	1,000	,913	,981	,999	,841
Company's profit	,955	,913	1,000	,974	-,932	,548
Profit per employee	,997	,981	,974	1,000	,990	,721
R&D expenses	,997	,999	-,932	,990	1,000	,814
Employee's learning process	-,770	,841	,548	,721	,814	1,000

Hypothesis 1 predicted a positive relationship between the employees' learning process and the profit in SME's. The value of the correlation between the two variables is positive (as seen in Table 2), both for the company's profit (,548) and for the profit per employee (,721)

Hypothesis 2 predicted a positive relationship between the employees' learning process and the innovation of products and processes in SME's. The value of the correlation between the two variables is positive (,814), which shows us that if the employees are more motivated and involved in the learning process, the R&D expenses are growing and thus, it is created an innovational environment inside the SME (see Table 2).

The negative correlation between R&D expenses and the company's profit (-,932) is justified because the more we invest in R&D and innovating, the short term profit will decrease.

5 Conclusions

One of the main conclusion that we can state from this research is that the employee's learning process can lead to an increase in the profit per employee in a greater measure than it leads to an increase in the company's general profit.

The employees' learning process has a great impact upon the R&D research, because a company with many trained employees has a greater chance to invest in innovation and research and development.

The negative correlation between the employees' learning process and the employees' educational level can be explained as follows: if an employee has a higher level of education, his will to develop himself further is getting lower. We can consider this a characteristic of the SME's, because in this environment, career development is lower and employees with a high educational level from a management position are not motivated enough to continue develop themselves through trainings.

Our findings prove that the learning process is an intrinsic motivational factor for employees, regardless of their sex or age.

As a conclusion, the learning process is an important factor for the innovative SME's as a source for the human resources' development. the effects that the learning process has upon the innovation of products and processes in SME's. This suggest that when the employees are engaged in learning behaviors, the innovative SME's environment seems more attractive to them.

References

- Amabile, T. M. (1996). *Creativity in context: Update to the social psychology of creativity*. Boulder, CO: Westview.
- Argyris, C, and D.A. Schon (1978). *Organizational Learning: A Theory of Action Perspective*. Reading, Mass.: Addison- Wesley
- Armour, H.O. and Teece, D.J. (1978). Organizational structure and economic performance: A test of the multi-divisional hypothesis. *The Bell Journal of Economics and Management Science*, 9, 106-122.
- Bakker, A. B., Albrecht, S. L., & Leiter, M. P. (2011). Key questions regarding work engagement. *European Journal of Work and Organizational Psychology*, 20(1), 4–28.
- Bapuji, H., M. M. Crossan, and M. J. Rouse (2005). "Organizational Learning— Methodological and Measurement Issues," paper presented at the 6th International Conference on Organizational Learning and Knowledge, Trento, Italy.
- Bateson, G. (1972). *Steps to an Ecology of Mind*. New York: Ballantine Books.
- Beckman, S.L. and Barry, M. (2007). Innovation as a learning process: Embedded design thinking. *California Management Review* 50(1), 25-56
- Bell, D. (1973). *The Coming of Post Industrial Society*. New York: Basic Books.
- Brettel, M. and Rottenberger, J.D. (2013). Examining the Link between Entrepreneurial Orientation and Learning Processes in Small and Medium-Sized Enterprises. *Journal of Small Business Management*, 51(4), 471–490

Burlea Schiopoiu, A. (2009). The Complexity of an e-Learning System: A Paradigm for the Human Factor, The Inter-Networked World: ISD Theory, Practice and Education. Vol. 2, pp. 267-278.

Burlea Schiopoiu, A. (2008). *Managementul resursei umane*, Editura Universitaria.

Burlea Schiopoiu, A. and Burdescu, D.D. (2016). *An Integrative Approach of E-Learning: From Consumer to Prosumer*, in Smart Education and e-learning 2016, Smart Innovation, Systems and Technology, Springer International Publishing Switzerland, Vol. 59, pp. 269-279.

Burlea Schiopoiu, A. and Remme, J. (2017). The Dangers of Dispersal of Responsibilities. *Amfiteatru Economic*, 19(45), pp. 464-476.

Chaston, I., Badger, B. and Sadler-Smith, E. (2001). Organisational Learning: An empirical Assessment of Process in small UK manufacturing firms. *Journal of Small Business Management*, 39(2), 139-151.

Covin, J. G., and D. P. Slevin (1989). Strategic Management of Small Firms in Hostile and Benign Environments, *Strategic Management Journal* 10, 75–87.

Crossan, M. M., H. W. Lane, and R. E. White (1999). An Organizational Learning Framework—from Intuition to Institution, *Academy of Management Review* 24(3), 522–537.

Cyert, R.M., and J.G. March (1963). *A Behavioral Theory of the Firm*. Englewood Cliffs, N.J.: Prentice Hall.

de Gues, A.P (1988). Planning as Learning. *Harvard Business Review*, March-April, 70-74.

Damanpour, F. and Evan, W.M. (1984). Organisational innovation and performance: The problem of “Organisational lag”. *Administrative Science Quarterly*, 29, 392-409

Dewey, J (1997). *Experience and Education*. New York, NY: Simon and Schuster

EIM/SEOR (2005) *Policy Instruments to Foster Training of the Employed*, vol. 1, Rotterdam

Easterby-Smith, M. (1997). Disciplines of Organizational Learning: Contributions and Critiques. *Human Relations* 50(9), 1085-1113.

Easterby-Smith, M., and M. Lyles (2003). “Introduction—Watersheds of Organizational Learning and Knowledge Management,” in The Blackwell Handbook of Organizational Learning and Knowledge Management. Eds. M. Easterby-Smith and M. Lyles. Malden, MA: Wiley-Blackwell, 1–15.

Eldor, L. and Harpaz, I. (2016). A process model of employee engagement: The learning climate and its relationship with extra-role performance behaviors, *Journal of Organizational Behavior*, 37, 213 – 235.

Ellinger, A. D., Ellinger, A. E., Yang, B., & Howton, S. H. (2002). The relationship between the learning organization concept and firms’ financial performance: An empirical assessment. *Human Resource Development Quarterly*, 13(1), 5–21.

Evan, W.M. (1976). Organization theory and Organizational effectiveness: An exploratory analysis. *Organization and Administrative Sciences*, 7, 15-28.

Frese, M., & Fay, D. (2001). Personal initiative: An active performance concept for work in the 21st century. *Research in Organizational Behavior*, 23, 133–187.

Grant, A. M., & Ashford, S. J. (2008). The dynamics of proactivity at work. *Research in Organizational Behavior*, 28, 3–34.

Griffin, M. A., Neal, A., & Parker, S. K. (2007). A new model of work role performance: Positive behavior in uncertain and interdependent contexts. *Academy of Management Journal*, 50, 327–347.

Huber, G.P (1991). Organizational Learning: The Contributing Processes and the Literatures, *Organization Science* 2, 88-115.

- Ilgen, D. R., & Pulakos, E. D. (1999). *The changing nature of performance: Implications for staffing, motivations, and development*. San Francisco: Jossey-Bass.
- Inkpen, A. C., & Tsang, E. W. (2005). Social capital, networks, and knowledge transfer. *Academy of Management Review*, 30(1), 146–165.
- Jashapara, A. (2003). Cognition, culture and competition: An empirical test of the learning organization. *Learning Organization*, 10(1), 31–50.
- Joo, B., & Lim, T. (2009). The impacts of organizational learning culture and proactive personality on organizational commitment and intrinsic motivation: The mediating role of perceived job complexity. *Journal of Leadership and Organizational Studies*, 15(4), 48–60.
- Kaluzny, A.D., Veney, J.E and Gentry, J.T. (1974). Innovation of health services: A comparative study of hospitals and health departments. *Health and Society*, 52, 51-82.
- Kolb, D.A. (1984). *Experiential Learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall
- Lawrence, T. B., M. K. Mauws, B. Dyck, and R. F. Kleysen (2005). The Politics of Organizational Learning—Integrating Power into the 4I Framework. *Academy of Management Review* 30(1), 180–191.
- Levine, A. (1980). *Why innovation fails?* Albany, NY: Suny Press
- Majovski, I. (2017). Major training barriers in small firms in Macedonia. *Economic Development* 3/2017, 89-102
- Mahoney, T.A. and Weitzel, W. (1969). Managerial Models of Organisational Effectiveness. *Administrative Science Quarterly*, 14, 357-365
- Mansfield, E. (1968). *Industrial Research and Technological Innovation: An econometric analysis*. New York: Norton
- March, J.G., and J.P Olsen (2016). *Ambiguity and Choice in Organizations*. Bergen: Universitetsforlaget.
- Mariampolski, H. (2005). *Ethnography for Marketers: A guide for consumer immersion*. Thousand Oaks, CA: Sage Publications.
- Maslow, A.H. (1970). *Motivation and personality*. New York: Harper & Row.
- Masson, R. C., Royal, M. A., Agnew, T. G., & Fine, S. (2008). Leveraging employee engagement: The practical implications. *Industrial and Organizational Psychology: Perspectives on Science and Practice*, 1, 56–59.
- Mites, R.H. (1980). *Macroorganizational Behavior*. Santa Monica, CA: Goodyear.
- Ok, W. & Tergeist, P. (2003). Improving workers' skills: Analytical evidence and the role of the social partners. *OECD Social, Employment and Migration Working Papers*
- Pulakos, E. D., Arad, S., Donovan, M. A., & Plamondon, K. E. (2000). Adaptability in the workplace: Development of taxonomy of adaptive performance. *Journal of Applied Psychology*, 85, 612–624.
- Rosner, M.M (1968). Administrative Controls and Innovation. *Behavioral Science*, 13, 36-43.
- Shane, S., and S. Venkataraman (2000). The Promise of Entrepreneurship as a Field of Research, *Academy of Management Review* 25(1), 217–226.
- Tay, L., Diener, E. (2011). Needs and subjective well-being around the world. *Journal of Personality and Social Psychology*, 101(2), 354-356. doi:10.1037/a00
- Van den Hooff, B., & Hendrix, L. (2004). *Eagerness and willingness to share: The relevance of different attitudes towards knowledge sharing*. Paper presented at the Fifth European Conference on Organizational Knowledge, Learning and Capabilities: Innsbruck, Austria.

Vigoda-Gadot, E., Eldor, L., & Schohat, L. M. (2013). Engage them to public service: Conceptualization and empirical examination of employee engagement in public administration. *American Review of Public Administration*, 43, 518–538.

Walker, J.L. (1969). The diffusion of innovation among the American States. *American Political Science Review*, 63, 880-899

Wang, C. L., and P. K. Ahmed (2002). "A Review of the Concept of Organisational Learning," Working Paper Series 2002, University of Wolverhampton, West Midlands, UK.

Webster, EE. (1992). The Changing Role of Marketing in the Corporation. *Journal of Marketing*, 56(10), 1-17.

Wiklund, J., and D. Shepherd (2005). Entrepreneurial Orientation and Small Business Performance: A Configuration Approach, *Journal of Business Venturing* 20, 71– 91.

Zahra, S. A., and D. Garvis (2000). International Corporate Entrepreneurship and Firm Performance: The Moderating Effects of International Environment Hostility, *Journal of Business Venturing* 15, 469– 492.

Yang, B., Watkins, K. E., & Marsick, V. J. (2004). The construct of the learning organization: Dimensions, measurement, and validation. *Human Resource Development Quarterly*, 15(1), 31–55.

Zull, J.E. (2002). *The art of changing the brain: enriching teaching by exploring the biology of learning*. Sterling, VA: Stylus.

Zhou, J., & Shalley, C. E. (2008). *Expanding the scope and impact of organizational creativity research*. In J. Zhou, & C. E. Shalley (Eds.), *Handbook of organizational creativity* (pp. 347–368). New York: Lawrence Erlbaum and Associates.

The Approach to Sustainable Development Learning in Knowledge Economy

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Abstract: The article aims to investigate the impact of sustainable development process and to analyze the effects of sustainability principles on students' behavior. Hence, the article seeks to develop a strategic model to explain the challenging building blocks of implementing a sustainable development learning approach in the academic environment. The objective of the article is to underline that sustainable development courses make a significant contribution to an effective responsible behavior of students. Our study develops a model of sustainable development learning in the academic environment and used a survey data collected from students of the University of Craiova. We organized the knowledge of the students into two categories: the level of students' knowledge and the impact of knowledge on students' behavior. The results revealed that knowledge transfer mediated the relationship between the sustainable development learning and responsible behavior of the students. Our model includes competencies and responsible behavior of the students, and shows that some formal attributes increase their motivations towards developing a responsible behavior.

Keywords: sustainable development learning, knowledge economy, strategic model, students' behavior

1 Introduction

Nowadays, it is increasingly difficult to define the relationships between phenomena and processes because technology is the variable that can change the nature and the intensity of the relationship at any time. In the Knowledge economy, technology represents a challenge for people because they are required to use it in the process of gathering and share the knowledge. Thus, technology becomes a challenge for the development of sustainable learning because it can both support and hinder the developing of knowledge processes (UN 2018, UNESCO 2017a; UNESCO 2017b).

The action of developing knowledge in the knowledge economy must take in consideration the dual nature of technology, as a driver or barrier and its role as enabler for knowledge development. The technological development of learning process enhances the efficiency of the knowledge sharing between students and contributes to the improvement of their creativity. Abramowitz (1989) stresses that the rate of return of investment in education and training will increase the value of human capital. Thus, the triple bottom mechanism which

enables the progress will be depicted through the interdependent relationship between knowledge-technology-sustainability.

The challenges of knowledge-based economy impact directly the sustainable development learning and develop the cognitive collaborative and cognitive analytical learning process by fostering collaboration and improving the decision-making process (Lee et al. 2007). Students become dependent on the use of information technology and they spend a lot of time searching on the Internet and browsing for the information that enables them to gather knowledge.

We analyzed the behavior of students related to identifying and extracting the information concerning the sustainable development learning process. Accordingly, we formulated the following research question:

Does knowledge sharing mediate the relationship between sustainable process and students' responsible behavior?

2 Literature Review

Knowledge sharing among students is an important activity, but improving its performance it is necessary to take into account two main attributes: the degree of interest that students have for knowledge, and how the information is shared between students (e.g. face-to-face by discussions or by technology). Scholars arrived at the conclusion that many factors encourage students to share their knowledge by using technology (Burlea Schiopoiu 2009; Nguyen et al. 2013; Paulin and Suneson 2012).

In light of these evidences, the factors that encourage students to interchange their knowledge by technology are: rapid communication, reliability, the increasing of socialization and interactions between students (Gaál et al. 2015; Zaqout and Abbas 2012).

Facebook is one of the preferred tool employed by students to acquire and share information mainly because of the feeling of an improved life satisfaction and boosted social trust that the platform induces to its users (Burlea Schiopoiu and Burdescu 2016; Irwin et al. 2010; Moghavvemi and Janatabadi 2017; Rouis 2012; Rouis et al. 2011; Valenzuela et al. 2009).

Jo-Anne Ferreira, Lisa Ryan and Daniella Tilbury (2007) analyzed the role of the teacher in promoting the sustainable education in relationship with six following factors: the nature and length of funding arrangements; the range and quality of partnerships and networks; the curriculum focus and the teaching and learning processes used; the nature of, and incentives for, participant engagement; the level at which a change was being sought; and the use of evaluation as a tool for learning and ongoing improvement.

Stephen Gough and William Scott (2003) discussed various aspects of the sustainable development and sustainable learning, and the relationship between environmental value, economic value and human value was considered important for the development of a responsible behavior.

Wiek and his colleagues (2013) underlined the importance of the sustainable learning development and the fact that students are required to develop their knowledge skills in order to put in practice sustainability ideas and, therefore, solve sustainable issues.

Our research hypotheses are the following:

H1: Knowledge about sustainability acquired through technology will increase the positive effect of sustainable development learning.

H2: Sustainable development learning will positively impact the responsible behavior of the students.

H3: Knowledge sharing will mediate the relationship between sustainable development learning and the responsible behavior of the students.

3 Methodology

We started the study by analyzing the 17 Sustainable Development Goals (SDGs) and we have adapted them to the framework of the sustainable development learning (figure 1). As a result, our model of sustainable development learning in the academic environment is based both on sustainable development goals and on students' vision and expectations. Thus, this model is founded on international premises applied to national framework. We organized the knowledge of the students into two categories: the level of students' knowledge and the impact of knowledge on students' behavior.

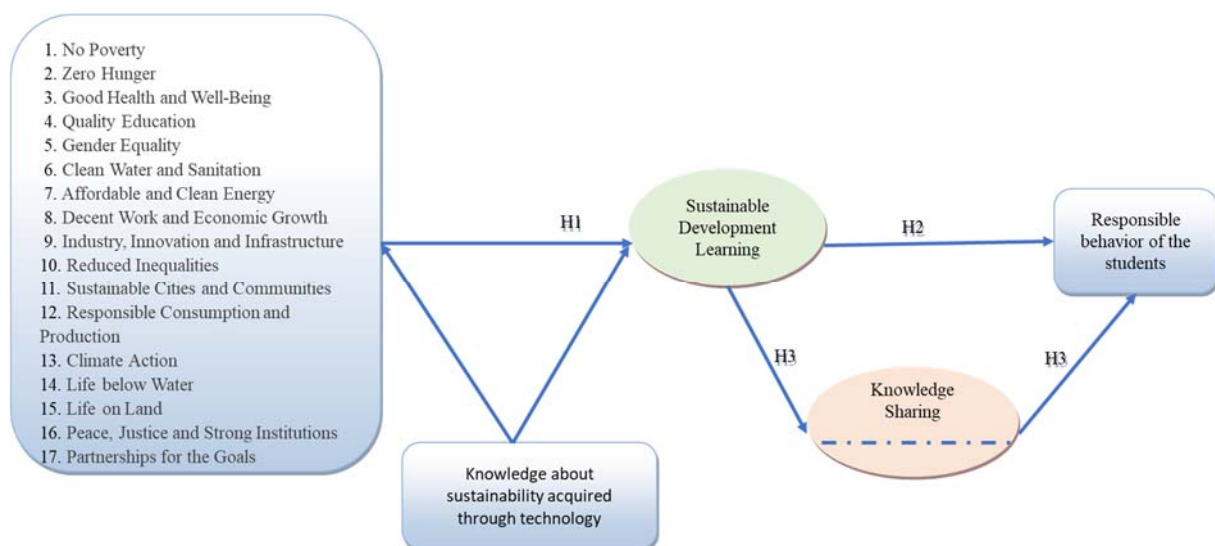


Figure 1: The theoretical model of sustainable development learning in the academic environment

3.1 Sample

To test our hypotheses, we conducted a survey during October to December 2017. In total, 275 students from the University of Craiova were invited to complete the questionnaire whose main objective was to assess the way they understand and apply in practice the

sustainable development learning in a knowledge-driven economy. All respondents who consented to take part to the study were asked to fill in a self-administered questionnaire. At the end of the fieldwork period, 250 valid questionnaires were returned, resulting in a response rate of 90.91%.

We used the following questions as control variables and we eliminated all questionnaires completed with negative answers.

* Have you studied about sustainable development at the faculty?

* Do you use technology to learn new knowledge about sustainable development?

The structure of the statistical population brought to the fore the following features: the subjects' average age is 24 (M=24.35, SD=1.519), the gender distribution indicating 151 females (60.4%) and 99 males (39.6%), and 147 students from the Faculty of Economics and Business Administration (58.8%) and 103 students from Faculty of Agriculture (41.2%).

3.2 Procedure

We evaluated the knowledge of the students from two main perspectives: the knowledge level that students have about sustainability acquired through technology and the impact of knowledge on their behavior.

We developed four main dimensions that closely describe the relationship between technology, knowledge, and sustainability. Each dimension was defined using a different number of items and each item was formulated as a question within a self-administrated questionnaire. In total, 19 items were included in the questionnaire and evaluated on a Likert scale with 5-points, where 1 means "Strongly disagree" and 5 means "Strongly agree".

All questions were centered on two main research issues, the knowledge and behavior of the students, thus creating the opportunity to evaluate how they understand and act in a situations related to sustainability.

The dimension related to knowledge about sustainability acquired through technology includes three items: first item evaluates the importance of using the technology in the learning process about sustainability (KsT1 - Do you consider that using the technology helps you to acquire relevant knowledge about sustainability?), the second item establishes a relationship between the decision-making process and the information found on the Internet (KsT2 - Do you make decisions related to sustainable learning taking into account the information you can find on the Internet?), and the third measures the impact of technology on student's sustainable decision-making process (KsT3 - It is important for you to use technology in the sustainable decision-making process?).

The dimension related to knowledge sharing comprises five items: the role of colleagues in the sharing of student's knowledge about sustainability values (KS1 - Are you open to share the knowledge about sustainability values when working with your colleagues?); the impact of the technology on the attitude of students when confronting with responsible dilemma (KS2 - Do you have a positive attitude when confronting with responsible dilemma and you don't use technology to solve it?); the use of technology for solving difficult responsible tasks

(KS3 - Are you able to solve difficult responsible tasks without using the technology?); the role of students' experience in analyzing sustainable information (KS4 - Do you analyze the sustainable information through your experience?); the preference of students when they have to share sustainable knowledge (KS5 - Do you prefer using technology when you share sustainable knowledge?).

The dimension that take into account the sustainable development learning process includes four items: the role of the colleagues in sharing the knowledge (SDL1 - Do you share your sustainable experience with your colleagues in order to better understand the issue?); the relationship between the importance of SDGs and efficient solutions to sustainable problems provided by students (SDL2 - Do you think that the perception you have on the importance of SDGs helps you to provide efficient solutions to sustainable problems?); the leverage of explicit knowledge about sustainability in providing logical solutions (SDL3 - Do you consider that explicit knowledge about sustainability helps you understand the meaning of this concept?); the relationship between the SDGs and personal values of the students (SDL4 - Are your personal values in consensus with SDGs?).

The dimension related to responsible behavior of the students includes seven items: the impact of knowledge on responsible behavior of the students (RBS1 - Is your responsible behavior influenced by the knowledge acquired through the learning process?); the importance of the evidence-based argument for developing the responsible behavior of the students (RBS2 - Do you take into account the evidence-based argument as very IMPORTANT factor when planning to develop your responsible behavior?); the relationship between knowledge about sustainability and the development of the students' responsible behavior (RBS3 - Do you think that the development of your responsible behavior depends on your knowledge about sustainability?); the perceived influence of personal values on enhancing students' responsible behavior (RBS4 - Do you think that your personal values help you to enhance your responsible behavior?); the valuation of sharing the sustainable knowledge with colleagues as an important factor in developing students' responsible behavior (RBS5 - Do you think that sharing your knowledge about sustainability with your colleagues is important for the development of your responsible behavior?); the belief that self-evaluation may be a factor for development of the students' responsible behavior (RBS6 - Do you analyze the results of your behavior when you face a problem related to your responsibility?); the role of difficult situation when it comes to describe students' responsible behavior (RBS7 - Do you think that difficult situations are a good opportunity to learn about the positive and negative aspects that describe your responsible behavior?).

3.3 Results and Discussions

We conducted a factor analysis to ensure a reliable measure of the four dimensions. We used Bartlett test of sphericity and Kaiser-Meyer-Olkin (KMO) test to evaluate the adequacy of the factor analysis in relationship with our data and the resulting value was assessed as being statistically significant $KMO = 0.935$, $Sig. = 0.000$, $Chi-Square = 7908.690$, $df = 171$. As a result, the structure of our factors is presented in Table 1. The Cronbach's coefficient was 0.937 and the reliability test it is very good (Nunnally 1978).

Table 1: The structure of the factors analyzed

Factor 1 Knowledge about sustainability acquired through technology	Factor 2 Knowledge Transfer	Factor 3 Sustainable Development Learning	Factor 4 Responsible behavior of the students
KsT1 = .938 KsT2 = .617 KsT3 = .642	KT1 = .811 KT2 = .593 KT3 = .588 KT4 = .767 KT5 = .822	SDL1 = .971 SDL2 = .981 SDL3 = .856 SDL4 = .923	RBS1 = .887 RBS2 = .245 RBS3 = .876 RBS4 = .893 RBS5 = .851 RBS6 = .742 RBS7 = .875

The descriptive statistics is presented in Table 2.

Table 2: Descriptive statistics of the variables

Items	Mean	Std. Deviation
Gender	1.60	.490
Age	24.35	1.519
Faculty	1.41	.493
KsT1	3.59	.798
KsT2	3.79	.748
KsT3	3.69	.670
KT1	3.76	.706
KT2	3.34	.791
KT3	3.24	.806
KT4	3.34	.588
KT5	3.65	.752
SDL1	3.70	.696
SDL2	3.65	.714
SDL3	3.62	.713
SDL4	3.77	.755
RBS1	3.71	.721
RBS2	3.82	.712
RBS3	3.71	.732
RBS4	3.74	.817
RBS5	3.49	.554
RBS6	3.91	.714
RBS7	3.74	.733

The descriptive analysis related to the knowledge about sustainability acquired through technology indicated that students consider the usage of technology as an important aspect in the learning process about sustainability ($M = 3.59$, $SD = .789$). The impact of technology on student's sustainable decision-making process is evaluated as being important as well ($M = 3.69$, $SD = .670$). The analysis revealed that students established a relationship between the decision-making process and the information found on the Internet ($M = 3.79$, $SD = .748$). Technology plays an important role in the process of acquiring knowledge and students use technology as a simple tool that helps them gather the needed information and not as strategic resource to make more informed decisions.

The descriptive analysis of the knowledge sharing variable indicates that students do not view the usage of technology as being an important enabler of solving difficult responsible tasks mentioning that they are able to accomplish their responsibility without making use of the technology ($M = 3.24$, $SD = .806$). This finding is reinforced by the lower average score obtained for the other two items which suggests that students project a positive attitude when confronting with responsible dilemma and they don't use technology to solve it. Instead, they use their experience in analyzing sustainable information ($M_2 = 3.44$, $SD_2 = .791$; $M_3 = 3.44$, $SD_3 = .588$). The role that their colleagues play in the sharing of student's knowledge about sustainability values registered the highest mean score ($M = 3.76$, $SD = .706$), which proves that inter-personal relationships are important contributors to the knowledge sharing between students. However, students tend to rely on technology and use it whenever they are confronted with a situation that requires sharing sustainable knowledge ($M = 3.65$, $SD = .752$).

The descriptive analysis regarding the sustainable development learning process indicated that students view the explicit knowledge about sustainability as an important aspect in providing logical solutions which helps them understand the meaning of this concept ($M = 3.62$, $SD = .713$). Moreover, a strong relationship between the importance of SDGs and efficient solutions to sustainable problems was identified by students ($M = 3.65$, $SD = .714$). The role of the colleagues in sharing the knowledge remains also important ($M = 3.70$, $SD = .696$). The item related to the relationship between the SDGs and personal values of the students registered the highest mean score ($M = 3.77$, $SD = .755$), which confirms that personal values of the students are in line with the SDGs.

The descriptive analysis related to responsible behavior indicates that students considered sharing the sustainable knowledge with their colleagues as an important factor in developing the responsible behavior ($M = 3.49$, $SD = .554$), which is influenced by the knowledge acquired through the learning process ($M = 3.71$, $SD = .721$) and also by their level of knowledge about sustainability ($M = 3.71$, $SD = .732$). The difficult situations are perceived as a good opportunity for students to learn about the positive and negative aspects that describe their responsible behavior ($M = 3.74$, $SD = .733$) and personal values of students contribute to enhance their responsible behavior ($M = 3.74$, $SD = .817$). The highest mean score was registered for the item evaluating the students' self-evaluation when faced with responsibility-related problem ($M = 3.91$, $SD = .714$) and the students take into account the evidence-based argument as very IMPORTANT factor when planning to develop their responsible behavior ($M = 3.82$, $SD = .712$).

The multiple regression analysis was used to test our hypotheses. The results obtained pointed out that - Knowledge about sustainability acquired through technology - had the strongest correlation coefficient ($\beta = .721$, $t = 10.536$, $p < .01$), followed by the responsible behavior of the students ($\beta = .452$, $t = 3.375$, $p < .01$) and the sustainable development learning ($\beta = .292$, $t = 2.092$, $p < .01$).

The correlations between variables are positive as following: the correlation between the knowledge about sustainability acquired through technology and the sustainable development learning is .882, the correlation between the sustainable development learning and the responsible behavior of the students is .971, the correlation between the knowledge

about sustainability acquired through technology and the responsible behavior of the students is .871.

Knowledge sharing is positively correlated with all three variables: knowledge about sustainability acquired through technology (.857), sustainable development learning (.782) and with responsible behavior of the students (.796).

As a result, all three hypotheses were validated.

4 The Importance that Students Assigned to the 17 Sustainable Development Goals

One of the findings of the research was to assess the importance that the students to both economic and agriculture studies have assigned to the 17 SDGs.

That is why students were invited to answer the following question:

Which of the 17 Sustainable Development Goals (SDGs) do you consider compatibles with the knowledge that you acquire in the learning process?

Every SDGs was evaluated on a Likert scale with value from 1 (less important) to 5 (very important). To process the answers to this question, we coded the 17 SDGs as depicted by Appendix 1.

Based on the answers provided to question investigating the prioritization of the 17 SDGs, we came to the conclusion that the field of studies exercises a great influence on how students understand the importance of sustainable knowledge (table 3).

Table 3. The importance that students to both economic and agriculture studies assigned to the 17 SDGs

Students from Economic field			Students from Agriculture field		
SGDs	Mean	Std. Deviation	SGDs	Mean	Std. Deviation
SDG1	4.19	.686	SDG2	4.20	.677
SDG4	4.12	.748	SDG14	4.18	.789
SDG11	4.11	.812	SDG3	3.98	.754
SDG16	3.98	.780	SDG6	3.97	.798
SDG17	3.97	.767	SDG7	3.95	.784
SDG3	3.97	.789	SDG4	3.95	.821
SDG10	3.96	.748	SDG15	3.90	.811
SDG9	3.92	.807	SDG13	3.90	.735
SDG5	3.90	.800	SDG9	3.89	.803
SDG8	3.90	.765	SDG12	3.88	.758
SDG12	3.80	.737	SDG8	3.88	.771
SDG7	3.58	.496	SDG11	3.87	.776
SDG6	3.54	.513	SDG17	3.83	.830
SDG2	3.12	.321	SDG1	3.63	.610
SDG14	3.09	.285	SDG10	3.13	.362
SDG15	3.08	.275	SDG5	3.10	.384
SDG13	3.05	.228	SDG16	3.07	.470

The finding revealed that students from the economic field are aware about economic SDGs and they assign a major importance to the following goals: “No poverty” (first place: N=4.19, SD=.686), “Quality Education” (second place: N=4.12, SD=.748), “Sustainable Cities and Communities” (third place: N=4.11, SD=.812), and less importance to the goal “Climate Action” (last place – 17th: M=3.05, SD=.228), “Life on Land” (16th place: N=3.08, SD=.275).

Students from the agriculture field are aware about quality of life related to the agriculture and climate and they give a major importance to the following goals: “Zero Hunger” (first place: N=4.20, SD=.677), “Life below Water” (second place: N=4.18, SD=.678), “Good Health and Well-Being” (third place: N=3.98, SD=.754), and less importance to the goal “Peace, Justice and Strong Institutions” (last place – 17th: M=3.07, SD=.470), “Gender Equality” (16th place: N=3.10, SD=.384).

Our analysis revealed that there is significant differences among male and female students in their classifications of the 17 SDGs (see table 4).

Table 4. The importance that students to both economic and agriculture studies assigned to the 17 SDGs [total (T) and by gender – Male (M) and Female (F)]

Students from Economic field			Students from Agriculture field		
SGDs – T	SGDs - M	SGDs – F	SGDs - T	SGDs - M	SGDs - F
SDG1	SDG1	SDG1	SDG2	SDG2	SDG2
SDG4	SDG4	SDG11	SDG14	SDG6	SDG14
SDG11	SDG11	SDG4	SDG3	SDG14	SDG15
SDG16	SDG5	SDG3	SDG6	SDG4	SDG3
SDG17	SDG16	SDG10	SDG7	SDG3	SDG7
SDG3	SDG17	SDG17	SDG4	SDG17	SDG4
SDG10	SDG3	SDG16	SDG15	SDG11	SDG13
SDG9	SDG10	SDG9	SDG13	SDG9	SDG12
SDG5	SDG9	SDG8	SDG9	SDG7	SDG9
SDG8	SDG8	SDG5	SDG12	SDG8	SDG6
SDG12	SDG12	SDG12	SDG8	SDG13	SDG8
SDG7	SDG7	SDG6	SDG11	SDG12	SDG11
SDG6	SDG6	SDG7	SDG17	SDG15	SDG17
SDG2	SDG15	SDG2	SDG1	SDG1	SDG1
SDG14	SDG2	SDG14	SDG10	SDG10	SDG10
SDG15	SDG14	SDG15	SDG5	SDG16	SDG5
SDG13	SDG13	SDG13	SDG16	SDG5	SDG16

The students from the economic field manifested a similar interest in the clasificassion of the 17 SDGs and the changes in the ranking are not significant. The studends from the agriculture field registered few changes in the ranking of the 17 SDGs (for example, for the SDG17 “Partnerships for the Goals” – male students ranked it on the 7th position and female students placed it on the 13rd position; for the SGD15 “Life on Land” – male students place it on the 13rd position and female students place it on the 3rd position).

5 Conclusions

We arrived at the conclusion that distribution of the knowledge related to sustainable development learning through formal networks (e.g. courses, workshops, conferences) is very important for the improvement of students' responsible behavior. In the knowledge economy, students are more inclined to work individually and to use technology as a mean for searching, filtering and selecting the information they need. The configuration of current academic system, described by the relationship between students, Professors, on one hand and business entities, in the other hand, in the development of responsible behavior and in promoting sustainability represents an important factor for progress.

In the academic environment, knowledge is one of the most important resources because it is, at the same time, produced and shared within and from the academic environment to business and social environment through different channels of communications (Burlea Schiopoiu and Remme 2017). The use of information technology impacts the knowledge-based economy and enhances the role of academic institutions in the development of human resources as both sustainable resource and source of sustainability.

Thus, the access to information is facilitated by Internet and the new generations of students acquire easily the skills and competencies related to the use of technology. Tacit knowledge is a challenge for students because they must be able to recognize, select and interpret the information. That is one of the main reasons for which formal learning will be not enough for developing the students' creativity and to educate them in a sustainable manner. Technology will try to diminish the role of learning in individual development process.

Based on the answers to the question about the selection of the most important SDGs, we came to the conclusion that the field of studies has a great influence on the way in which students understand the meaning of the sustainable knowledge.

Appendix 1 – Operational coding for the 17 SDGs

- SDG1 - No Poverty
- SDG2 - Zero Hunger
- SDG3 - Good Health and Well-Being
- SDG4 - Quality Education
- SDG5 - Gender Equality
- SDG6 - Clean Water and Sanitation
- SDG7 - Affordable and Clean Energy
- SDG8 - Decent Work and Economic Growth
- SDG9 - Industry, Innovation and Infrastructure
- SDG10 - Reduced Inequalities
- SDG11 – Sustainable Cities and Communities
- SDG12 - Responsible Consumption and Production
- SDG13 - Climate Action
- SDG14 - Life below Water

SDG15 - Life on Land

SDG16 - Peace, Justice and Strong Institutions

SDG17 - Partnerships for the Goals

References

Abramowitz, M., 1989. *Thinking about Growth*, Cambridge University Press, Cambridge.

Burlea Schiopoiu A., 2009. The Complexity of an e-Learning System: A Paradigm for the Human Factor, *The Inter- Networked World: ISD Theory, Practice and Education*. Vol. 2, pp. 267-278.

Burlea Schiopoiu A., Burdescu D.D., 2016. An Integrative Approach of E-Learning: From Consumer to Prosumer, in *Smart Education and e-learning 2016, Smart Innovation, Systems and Technology*, Springer International Publishing Switzerland, Vol. 59, pp. 269-279.

Burlea Schiopoiu A., Remme J., 2017. The Dangers of Dispersal of Responsibilities. *Amfiteatru Economic*, 19(45), pp. 464-476.

Ferriera, J., Ryan, L., Tilbury, D., 2007. Planning for Success: Factors influencing change in teacher Education, *Australian Journal of Environmental Education*, 23, pp 45-55.

Gaál Z, Szabó L, Obermayer-Kovács N., Csepregi A., 2015. Exploring the role of social media in knowledge sharing, *The Electronic Journal of Knowledge Management*, 13(3), pp.185-197.

Gough, S., Scott, W., 2003. *Sustainable Development and Learning: framing the issues*, Routledge.

Lee W.B., Cheung B.C., Tsui E., Kwok S.K., 2007. Collaborative Environment and Technologies for Building Knowledge Work Teams in Network Enterprises. *International Journal of Information Technology and Management*, 6(1), pp. 5–22.

Naustdalslid J., 2011. Climate change – the challenge of translating scientific knowledge into action, *International Journal of Sustainable Development & World Ecology*, 18:3, 243-252, DOI: 10.1080/13504509.2011.572303

Nguyen, N. P., Yan, G., Thai, M. T., 2013. Analysis of misinformation containment in online social networks. *Computer Networks*, 57(10), pp. 2133-2146.

Nonaka I.R., Toyama R., Hirata T., 2008. *Managing flow: A process theory of the knowledge-based firm*, Palgrave Macmillan, New York.

Nunnally, J., 1978. *Psychometric theory*. New York: McGraw-Hill Book Company.

Paulin, D., Suneson, K., 2012. Knowledge transfer, knowledge sharing and knowledge barriers-Three blurry terms in KM. *The Electronic Journal of Knowledge Management*, 10(1), pp.81-91.

Polanyi M., 1983. *The tacit dimension*, Peter Smith, Gloucester.

Scott, W., Gough, S., 2003. *Sustainable development and learning: Framing the issues*. London: Routledge Falmer.

Spaiser V., Ranganathan S., Bali Swain R., Sumpter, D.J.T., 2017. The sustainable development oxymoron: quantifying and modelling the incompatibility of sustainable development goals, *International Journal of Sustainable Development & World Ecology*, 24:6, 457-470, DOI: 10.1080/13504509.2016.1235624

United Nations Educational, Scientific and Cultural Organization, 2017a. *Education for Sustainable Development Goals: Learning Objective*. Paris, France.

United Nations Educational, Scientific and Cultural Organization, 2017b. *Transforming our world: the 2030 Agenda for Sustainable Development*, sustainabledevelopment.un.org (Accessed on 10 March, 2018).

United Nations, 2018. *The 17 Sustainable Development Goals (SDGs)*, <https://www.un.org/sustainabledevelopment/sustainable-development-goals/> (Accessed on 15 January, 2018).

Wiek, A., Bernstein, M., Laubichler, M., Caniglia, G., Minter, B., Lang, D., 2013. A Global Classroom for international sustainability education. *Creative Education*, 4(4A), 19-28.

Zaqout, F., Abbas, M., 2012. Towards a model for understanding the influence of the factors that stimulate university students' engagement and performance in knowledge sharing. *Library Review*, 61(5), pp.345-361.

Crowdsourcing for employee engagement – municipal office study

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Abstract: Crowdsourcing is seen as a way to acquire knowledge, ideas, and solutions to problems. Literature postulates that it can also be a way to increase employee engagement. However, these findings remain in the sphere of purely theoretical considerations. This article aims at seeking the interdependence between crowdsourcing and employee engagement in public organisations. The subject of the study is to indicate the possibilities of using crowdsourcing to increase employee engagement in municipal offices which use crowdsourcing. Understanding these relationships, public organisations are better able to use the crowdsourcing potential. The data were collected using a survey questionnaire conducted among all 22 identified city offices which make use of crowdsourcing, with an effective sample of 18 municipal offices. A correlation analysis was carried out using a two-dimensional approach. The research results show that crowdsourcing is positively and moderately related to employee engagement.

Keywords: crowdsourcing, employee engagement, employee intellectual engagement, employee social engagement, employee affective engagement, public sector

1 Introduction

Crowdsourcing has recently been enjoying interest in management literature, in particular in the context of the public sector. Early recognition of the importance of crowdsourcing for the public sector can be related to the generation of better quality public services, while reducing costs, creating innovation, and increasing the efficiency of public services. Crowdsourcing increases information generation, creating solutions (Nam, 2012), fosters solving of organisational problems (Brabham, 2008), enables and improves establishing and building relationships and collaboration with virtual communities (Albors, Ramos, Hervas, 2008), which further increases the transfer to the organisation of external knowledge, talents (Burger-Helmchen, Pénin, 2010), valuable information (Greengard, 2011), skills, experience, and competences (Chanal, Caron-Fasan, 2008). This stimulates the organisational learning and openness of the organisation to new external knowledge (Majchrzak, Malhotra 2013). In addition, it improves knowledge management (Callaghan, 2016). As research shows, crowdsourcing increases the involvement of citizens in the production and improvement of public services (Fung 2015). The literature shows that crowdsourcing can facilitate relations between public employees and citizens (Brabham, 2015, Prpić, Taeihagh & Melton, 2015;

Seltzer & Mahmoudi, 2013). It has been pointed out that this is a new area of research (Brabham, 2008).

The cases of international companies suggest that crowdsourcing can contribute to increased employee engagement (Zuchowski *et al.*, 2016). For instance, in the IBM project called "Innovam Jams" employees generate new ideas and innovations to improve the organisation, while at Deutsche Telekom, employees publish their knowledge and ideas on a special platform (Bjelland & Wood, 2008). Both these examples are a proof of a successful implementation of internal crowdsourcing – through brainstorming the employees get engaged in the life of the organisation. Many researchers have recognised the potential of internal crowdsourcing for decision-making (Schneider *et al.*, 2012). However, there is little research on this subject. Interestingly, empirical research refers only to the use of internal crowdsourcing to achieve specific goals of the organisation (Geiger *et al.*, 2011), create innovation, engaging employees (Riemer & Scifleet, 2012) and virtual communities (Simula & Ahola, 2014). However, studies conducted in B2B companies show that crowdsourcing, not only the internal one, can stimulate employee engagement.

Since 2008, there has been a tendency for public organisations to include crowdsourcing into their activities. The legitimacy of using crowdsourcing in public organisations is justified by the fact that in the commercial sector "it is not dependent on anyone but sponsors", while in the public sector the importance of citizens is emphasised (Seltzer & Mahmoudi, 2013). A review of the current state of knowledge on crowdsourcing suggests conducting future research in the public sector (Liu, 2017), since it is a challenge and a future for public organisations.

Therefore, the aim of this research is to examine the relationships between crowdsourcing and employee engagement. To study the relationship between these variables, a correlation analysis was performed. The research was carried out at municipal offices that use crowdsourcing - because this sector requires research in the field of crowdsourcing (Liu, 2017).

2 Theoretical background

2.1 Crowdsourcing and engagement of municipal office employees

The first definition of crowdsourcing defines it in the following way: "a company posts a problem online, a vast number of individuals (the "crowd") offer solutions to the problem, the winning ideas are awarded some form of a bounty, and the company mass produces the idea for its own gain" (Brabham, 2009). Crowdsourcing understood in this way is considered a problem-solving model in which the collective intelligence of the virtual community is used (Afuah & Tucci, 2013). Thus, crowdsourcing focuses on crowd wisdom, and more precisely: "under the right circumstances, groups are remarkably intelligent, and are often smarter than the smartest people in them" (Surowiecki, 2004).

Crowdsourcing requires the involvement of members of the virtual community, but also the organisation's employees (Simula & Vuori, 2012). The complexity of public organisations, the growing expectations of citizens, the need to treat citizens as customers, requires their inclusion in the creation of new products, solutions, improvement processes (McGuire, 2006)

and the implementation of openness requirements, efficiency, responsibility, effectiveness and the inclusion of innovations in the strategies of public organisations. Therefore, the use of crowdsourcing in these organisations makes sense, because it allows citizens to participate in the life of the organisation and increase their responsibility and engagement in the implementation of public tasks. In addition, crowdsourcing increases the organisation's openness to knowledge that comes from the virtual community. There is also a reorientation of the organisation from a hermetic one to implementing a democratising strategy and an open one, that is, engaging in generating, discussing, and evaluating ideas. Such cooperation with virtual communities appears as a factor increasing employees' ability to process a variety of information and knowledge. In addition, the organisation employee's lack of interest in crowdsourcing may lead to his/her exclusion, alienation, internal conflicts and a decrease in engagement (Wooldridge *et al.*, 2008). However, very little work focuses on the relationship between crowdsourcing and employee engagement. There are only signs that employee resistance can be a serious threat when it comes to crowdsourcing.

Earlier literature shows that research on employee engagement is mainly carried out in commercial organisations, leaving a gap in the context of public organisations. At the same time, it points out that employee engagement models developed for commercial organisations may apply to public organisations (Boselie, 2010) – however, the need to understand the employee engagement in public organisations is emphasized (Pritchard, 2008). In the few surveys conducted in the public sector, it is suggested that the low level of employee engagement leads to decreasing loyalty, a decline in the sense of pride and negative perception of management. In addition, it is suggested that access to information, efficient communication, the organisation's image, its innovation, impact on decision-making - have an impact on the high level of employee engagement. All this suggests that you can expect positive interdependencies between crowdsourcing and employee engagement.

To sum up, due to the lack of previous empirical studies on the importance of crowdsourcing for the engagement of public organisation employees, theoretical suggestions were taken into account - and on their basis the following research hypotheses were formulated:

H1. There is a positive relationship between crowdsourcing and the engagement of municipal office employees.

H1a. There is a positive relationship between crowdsourcing and intellectual engagement of municipal office employees.

H1b. There is a positive relationship between crowdsourcing and social engagement of municipal office employees.

H1c. There is a positive relationship between crowdsourcing and affective engagement of municipal office employees.

It is believed that employee engagement affects productivity, organisational efficiency, and improvement of the quality of services offered, in particular the last one mentioned is important in the face of the growing expectations of public organisations by residents. The research suggests that the growing pressure of citizens, the necessity of openness and

transparency of public organisations, but also changes in functioning - have resulted in moving away from bureaucratic structures to market and customer-oriented highly effective and flexible entities. As in most Western countries, the public sector in Poland constitutes a large part of the Gross Domestic Product and employs a significant part of the labour force (McKevitt & Lawton, 1997). Since the mid-1970s, the public sector's public policy has been heavily criticized, which led to a number of public reforms in the early stage of the 1980s. In response, the New Public Management (NPM) has focused on transferring management principles in force in the private sector to the public sector context. This has contributed to the increase in the importance of the human capital and the focus on the employee engagement in public organisations (Pike *et al.*, 2005). There is also pressure to reach for new solutions improving the implementation of public services by employees (Osborne, Gaebler, 1992). On the one hand, the literature suggests that employee engagement influences the success of a crowdsourcing initiative. On the other hand, crowdsourcing affects employees engagement (Aalbers *et al.*, 2013). That is why it is important to investigate whether crowdsourcing and employee engagement are interrelated.

3 Empirical research design

3.1 Sample and data

The study assumes that those municipal offices that use crowdsourcing in their activities will be included in the analysis. The target population of the municipal offices in Poland that use crowdsourcing was identified using two data sources: a list of cities using the crowdsourcing platform called NaprawmyTo (www.naprawmyto.pl) and a selection of municipal offices in accordance with the "snowball" method. In this way 22 municipal offices that use crowdsourcing were identified. Invitations were sent by e-mail to all potential respondents. It was taken into account that the control procedures may limit the risk of non-response, three reminders were sent. In addition, to reduce the risk of non-response that leads to a complete lack of response, the study was conducted in mixed mode using data collected using a variety of research techniques.

Data collection was begun in January 2018 and ended in March 2018. The data collection process was carried out via a survey questionnaire posted using the Webankieta system, as well as by sending questionnaires by electronic mail. The type of data collection techniques depended on the choice made by the respondents when the invitation to participate in the study was sent. It should be emphasised that despite differences in data collection techniques, no differences were noticed in the responses of the respondents. A total of 101 correctly filled questionnaires were collected.

3.2 Measurement scales

Research focused on two variables: crowdsourcing and employee engagement. It should be emphasised that in the case of crowdsourcing, the approach proposed by Xu, Ribeiro-Soriano, and Gonzalez-Garcia (2015) was adopted. It includes 8 items that include crowdsourcing at the organisational level. Crowdsourcing will be examined taking into account the possession

of a crowdsourcing platform, its functionality, and strategic actions taken by the organisation in order to encourage the virtual community to cooperate on creating original services, solving problems, and reporting defects. According to this approach, crowdsourcing includes: consumer participation in product development and configuration, competitive proposals for tasks or problems, permanent open calls, community reports, and evaluation of services by consumers. The final items selected to measure crowdsourcing are presented in the Annex (Table A1).

The applied scale consists of questions formulated positively. The first analyses that were carried out evaluated the reliability of the data and scales. The scope of the common methodological bias was assessed. Harman's single factor test (Podsakoff, MacKenzie, Lee & Podsakoff, 2003) was carried out to check the common variance of the method. Using unprocessed data, it was confirmed that there is no CMB risk, because the factor with the highest eigenvector, identified using non-rotational analysis, explains only 57.5% of the total variance.

In the case of employee engagement, an original multidimensional approach to employee engagement was adopted, including its conceptualisation by Kahn (1990). In response to Kahn's three-dimensional conceptualisation, researchers Soane, C. Truss, K. Alfes, A. Shantz, C. Ress, and M. Gatebny proposed to measure employee engagement using an ISA Engagement Scale. The Polish version of the ISA scale was carried out in accordance with the methodological guidelines recommended by the International Test Commission (ITC) and the European Federation of Psychologists Associations (EFPA) (Muñiz & Bartram, 2007). In this way, the original instrument was first translated into Polish by a translator specialising in scientific terminology. Employee engagement can be measured in three dimensions: intellectual engagement, social engagement, and affective engagement (Soane *et al.*, 2012). In this sense, an engaged employee fully expresses his/her true self at work and through work (Kahn, 1990). Engagement means psychologically as well as physically present when occupying and performing an organisational role. Therefore, in the article, employee engagement is conceptualised in accordance with Kahn's approach, which is the optimal choice for the employee engagement theory. Accordingly, the scale proposed by Soane, Truss, Alfes, Shantz, Ress, and Gatebny (2012) will be used to measure employee engagement.

The survey was carried out using a questionnaire with a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), with 3 as a neutral reaction.

4. Analysis and results

The first analyses which were carried out evaluated the reliability of data and scale. The applied research tool is composed of two parts, which include a total of 17 positively formulated questions, grouped according to a specific dimension of employee engagement, which may involve the Common Method Bias risk (CMB) (Podsakoff *et al.*, 2003). The tool was tested with the use of Harman's single factor test (Kraus *et al.*, 2012). Using unprocessed data, it was confirmed that there is no CMB risk, because the factor with the highest eigenvector identified, using non-rotational analysis, explains only 57.55% of the total variance - in the

case of organisational engagement) and 66.76% - in the case of crowdsourcing (the limit in case of management research is 70%).

In the case of crowdsourcing, we are dealing with a large number of internally linked indicators, which may mean that the relationships between them may result from the existence of one or more common factors that are associated with individual indicators of the analysed variables. This constitutes the basis for the application of the exploratory factor analysis. The advantage of this analysis is the ability to determine a number of hidden variables that sufficiently explain the interrelationships between many observable variables. In addition, the two-component tool was tested for internal consistency. In the beginning, a principal component analysis (PCA) and Varimax rotation were performed as possible interdependencies between variables had been assumed. Varimax rotation allows minimising the number of variables with high factor loadings. The obtained results indicate the legitimacy of further analysis of the exploratory factor analysis, in particular the obtained results of the Kaiser-Mayer-Olkin measure (KMO) and the Bartlett sphericity test. As a result, an acceptable level of adequacy of the sample selection was obtained. The KMO for crowdsourcing amounted to 0.834, while for employee engagement it equalled 0.899. It is assumed that KMO makes sense when it takes a value greater than 0.5. On the other hand, Bartlett's sphericity test examines the significance of Pearson's correlation coefficient between pairs of variables. The Bartlett test shows that for crowdsourcing $\alpha < 0.05$ and employee engagement $\alpha < 0.05$, hence the H_0 hypothesis that all correlation coefficients are statistically insignificant, we can reject and accept the H_1 hypothesis, i.e. $H_1: \sim H_0$. Based on the matrix of correlation coefficients and the significance of these coefficients, links between particular questions were created (Table 1).

Table 1. Component matrix

Item	Component			
	1	2	3	4
CS1	0.136	0.696	0.201	0.216
CS2	0.149	0.219	0.126	0.898
CS3	0.034	0.428	0.126	0.751
CS4	0.096	0.789	0.079	0.189
CS5	-0.055	0.719	0.097	0.429
CS6	0.122	0.306	0.148	0.888
CS7	0.268	0.655	-0.111	0.429
CS8	0.213	0.573	0.489	0.027

Source: own elaboration.

Factors that have been highlighted by high loadings were distinguished. The factor constituent that had loadings greater than 0.6 were taken into account. Factor loadings of less than 0.6 were omitted. Some of the constituents overlap and reflect only one factor. Based on the results of the exploratory factor analysis with Varimax rotation, the general scale of crowdsourcing has to be divided into two dimensions, because the elements C2, C3, and C6 belong to an independent factor. Whereas, element C8 was excluded from further analyses due to low loadings. The author called this factor "promotion of the best ideas". For the rest of the analysis, the variable "crowdsourcing" will consist of the following elements: C1, C4, C5, and C7.

In order to assess the accuracy and reliability and verification that all components of the questionnaire reliably describe the variables under consideration, and that the scales and measures used in them are coherent, they were tested using Cronbach's alpha, which allows to state that Cronbach's alpha for crowdsourcing, measured by four constituents, is satisfactory because it has reached the value of 0.813. However, in the case of employee engagement, all employee engagement dimensions are sufficiently reliable: intellectual engagement ($\alpha = 0.904$), social engagement ($\alpha = 0.852$), and affective engagement ($\alpha = 0.727$). All scales for employee engagement take the value $\alpha = 0.934$, which signifies that the final form of the research tool is reliable. The new variable "promotion of the best ideas" is also sufficiently credible ($\alpha = 0.914$).

4. Correlation analysis

In order to make a general evaluation of the relationship between the constructs, a correlation was carried out between the variables (between crowdsourcing and employee engagement and its dimensions as well as crowdsourcing and the promotion of the best ideas), calculated by averaging their position results. To deepen the research further, the correlation analysis was supplemented with an analysis between crowdsourcing and three dimensions of employee engagement (intellectual, social, and affective). The obtained results of Bartlett's sphericity test and the fact that the analysed variables are perceived as continuous - allowed using correlation analysis by applying Pearson correlation coefficient and parametric tests. The mean and standard deviation of the variables are presented in Table 2. All calculations were made using the mean values, because in the study a multi-item approach was adopted for the considered variables. The calculations were made using IBM SPSS version 23 and Statistica 13 software.

Table 2: Descriptive statistics and correlations between the variables

Item	Variable	Mean	SD	1	2
1.	Crowdsourcing	2.920	0.981		
2.	Employee engagement	3.789	0.846	0.406*	
	Intellectual engagement	4.026	0.892	0.287*	
	Social engagement	3.729	0.922	0.357*	
	Affective engagement	3.613	0.891	0.501*	
3.	Promotion of the best ideas	3.481	1.233	0.680*	0.374*

* $p < 0.05$

As the Table shows, crowdsourcing is positively associated with employee engagement and its individual dimensions. Although all interdependencies are statistically significant, they are rather moderate. More specifically, there is a moderate relationship between crowdsourcing and employee engagement ($r_{xy} = 0.406$, sig. < 0.05), while the strongest correlation between crowdsourcing and employee affective engagement is observed ($r_{xy} = 0.501$, sig. < 0.05). However, in the case of the dependence between crowdsourcing and intellectual engagement, a weak correlation is observed ($r_{xy} = 0.287$, sig. < 0.05). The results of the correlation analysis show that the moderate relationship between crowdsourcing and employee engagement (H1). In addition, there is a weak relationship between crowdsourcing and intellectual engagement (H1a), between crowdsourcing and social engagement (H1b).

However, there is a strong relationship between crowdsourcing and affective engagement (H1c). Crowdsourcing shows a high correlation with the promotion of the best ideas ($r_{xy} = 0.374$, sig. <0.05). In addition, one-way ANOVA was performed to check the significant differences between the variable means. The hypotheses were examined jointly using SMARTPLS 3.2.7. PLS which is a contrasting statistical method of the causal network of implicit variables. Figure 1 shows the measurement model and structural model with the main parameters. All constructions use the reflexive measurement model.

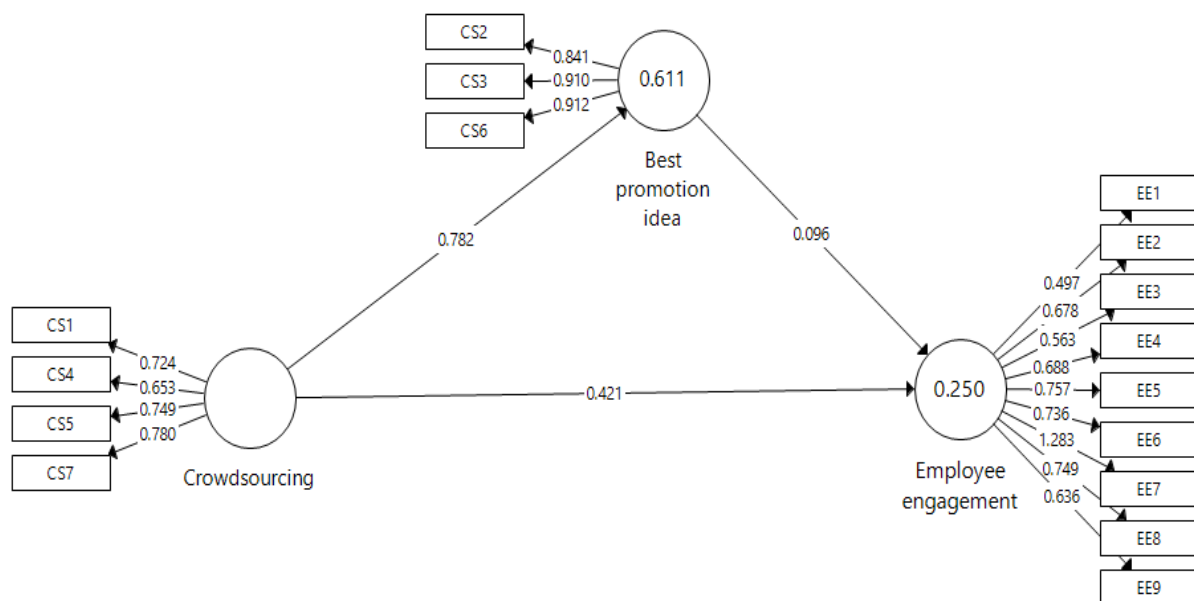


Figure 1: PLS model

The structural model presented in Figure 1 summarises the hypotheses. As the results show, the conformity of the constructs is justified by the significant individual normalised loadings of the objects, the majority of which has a greater than the recommended threshold of 0.7. The complex reliability and average variance extraction (AVE) of each construct is given in the table presented in Appendix. The complex reliability should range from 0.70 to 0.95. Hypothesis 1 has been confirmed due to the significant value of the path between crowdsourcing and employee engagement. Subsequently, another PLS analysis was carried out. Hypothesis 1a is also confirmed by the high path ratio between crowdsourcing and intellectual engagement (0.347). Hypothesis 1b has been confirmed (0.433). The highest path value was obtained by Hypothesis 1c between crowdsourcing and affective engagement (0.657). A significant impact was also found between crowdsourcing and the promotion of the best ideas (0.780).

5 Discussion

This article is a voice in an important discussion on the importance of crowdsourcing for employee engagement in municipal offices. It is intriguing and at the same time important subject from the point of view of creating the theory and practice of public organisation management. The studies carried out have specific implications. First of all, they show crowdsourcing as a still developing strategy for the municipal offices. 18 out of 22 identified

municipal offices using crowdsourcing were studied. The return rate is over 81%. According to the author's knowledge, the above studies provide a reliable indication of the actual use of crowdsourcing in municipal offices in Poland. Secondly, the conducted analyses show the possible path of the impact of crowdsourcing on employee engagement and its position in the municipal offices. They outline the primary role of crowdsourcing in stimulating employee engagement, in particular affective engagement of employees. The obtained results confirm the latest discoveries showing the importance of crowdsourcing for affective engagement. However, the research was conducted in the insurance industry (Troll & Blohm, 2017). Such results are justified by the need to understand the mechanisms of employee engagement in crowdsourcing (Dontcheva *et al.*, 2014). Determining the importance of crowdsourcing for individual employee engagement dimensions extends previous literature, which focused mainly on the engagement of virtual communities (Nguyen 2016) and internal crowdsourcing (Zuchowski *et al.*, 2016).

Crowdsourcing and employee engagement

The present studies focused on crowdsourcing recognised as a problem solving model in which collective intelligence of the virtual community is used, while the existing literature includes crowdsourcing primarily on the level of virtual communities. In particular, this research shows crowdsourcing as an important tool for human resources management, and more specifically an important factor for employee engagement. It shows correlation results on positive and directional ties between crowdsourcing and employee engagement. However, most of the identified relationships are rather moderate (Table 3). Only intellectual engagement and social engagement do not show any significant dependence on crowdsourcing.

Table 3: Results of testing the hypotheses

Hypothesis	Pearson's r	Testing
H1. There is a positive relationship between crowdsourcing and the engagement of municipal office employees.	0.406	✓
H1a. There is a positive relationship between crowdsourcing and intellectual engagement of municipal office employees.	0.287	✓
H1b. There is a positive relationship between crowdsourcing and social engagement of municipal office employees.	0.357	✓
H1c. There is a positive relationship between crowdsourcing and affective engagement of municipal office employees.	0.501	✓

Source: own elaboration.

As the Table shows, crowdsourcing is positively associated with employee engagement and its individual dimensions. Although all interdependencies are statistically significant, they are rather moderate. This can be explained by the public sector's specificity. The expectations of a public sector employee mainly relate to the goals and values in force in this sector. The public sector is specialised, which may make it difficult to reflect on the work performed and be socially engaged. In particular, taking into account that the specificity of work in a public organisation requires rather individual work than a team work. The above findings are supplemented by previous research, in which crowdsourcing had contributed to the engagement of employees in the case of other companies, namely IT and postal services

(Xarchos, 2008). It can therefore be said that crowdsourcing can be a new strategy for public sector organisations. However, this requires proper coordination.

It should be emphasized that the association of crowdsourcing with employee engagement is related to the specificity of the sector. The literature indicates that employee engagement in public organisations does not differ from the engagement of employees of commercial organisations. However, it should be borne in mind that the public sector is characterised by a lack of administrative creativity and the inability to adapt new solutions.

6 Conclusion

The obtained research results provide an insight into the importance of crowdsourcing for the engagement of employees of municipal offices. In this way they are a contribution to the theory of management - because the study combines these two phenomena and takes into account these connections in the previously unexplored public sector. These studies are a significant contribution to both crowdsourcing and employee engagement.

First, the research carried out takes a new look at crowdsourcing. Previously, it was combined with the improvement of business processes, creation of open innovations (Burger-Helmchen & Penin, 2010), building competitive advantage (Leimeister & Zogaj, 2013), access to experience, innovation, information, skills and work of the crowd that are located outside the organisation (Vukovic & Bartolini, 2010). Crowdsourcing also allows managing crises, expand current activities and offer of the organisation, create the image of the organisation, improve communication with the environment, and optimise the costs of the organisation. Only few authors have proposed combining crowdsourcing with employee engagement (Aalbers *et al.*, 2013). Research focused rather on the importance of employee engagement for the success of a crowdsourcing initiative. The research carried out in this work sheds new light on the interdependencies between crowdsourcing and the employee engagement of municipal offices. Positive testing of the assumed hypotheses suggests the importance of crowdsourcing for employee engagement, although the interdependencies are rather weak and the explanation power of the tested model is moderate. The results show that shaping employee engagement may result mainly from possessing of a crowdsourcing platform, motivating the virtual community, evaluating the submitted ideas and their implementation by the municipal offices. The research, however, contributes to the theoretical assertions confirming a positive relationship between crowdsourcing and employee engagement, but directed in the opposite way compared to the relations studied so far: employee engagement-crowdsourcing.

Second, the research carried out is a contribution to the theory of management. The crowdsourcing measurement tool in the public sector was tested, which is a response to the recommendations of other researchers (Xu, Ribeiro-Soriano & Gonzalez-Garcia, 2015). Referring to the aforementioned research, the developed tool for measuring crowdsourcing is different from them. It can therefore be considered that the crowdsourcing conceptualisation may vary depending on the studied sector. In addition, a new variable "promotion of the best ideas" was distinguished, which strongly correlates with crowdsourcing.

Third, focusing on the public sector, this article extends the existing arrangements on crowdsourcing and employee engagement in under-researched areas. The conducted research gives a new look at crowdsourcing and employee engagement from the point of view of strategic management, whereas the current approaches are limited to internal crowdsourcing oriented on employee participation. It is important that the internal openness of employees to external knowledge, their attitude (Ederer & Manso, 2013), their perception of the benefits may cause that new solutions, ideas acquired from the crowd will be adopted, disseminated, and assimilated by them, while knowledge will be used to propose improvements at their workplaces or for the entire division/department and building their own reputation (Blohm *et al.*, 2011).

Fourth, the research carried out contributes to increasing the knowledge about employee engagement, because in fact it provides quantitative data necessary to supplement the knowledge about employee engagement (Iddagoda & Opatha, 2017). In addition, this research is focused on municipal offices from Poland. In this way, it is in line with the desired research directions on issues related to crowdsourcing in the case of municipal offices, especially since it is considered a trend and a challenge for these organisations in Europe.

The tests studies carried out are not free of their limitations. First of all, it was possible to collect data from 18 municipal offices in Poland. Thus, the sample can be seen as relatively small, being 1.93% of all municipal offices in Poland (according to the Ministry of Internal Affairs and Administration there are 930 municipal offices in Poland). However, it should be emphasised that only 22 cities in Poland use crowdsourcing, and 18 of them have been studied (return rate of 81.81%). However, it should be emphasised that these are the only crowdsourcing studies conducted so far in municipal offices in Poland. In addition, the final sample size allows the use of data analysis. Considering the above, it is pointed out that further research should be conducted on a larger sample.

Another limitation is that the study was conducted in mixed mode. The data collection process was carried out via a survey questionnaire posted using the Webankieta system, as well as via questionnaires sent by electronic mail. This approach may affect the respondents' answers, in particular the truth and reliability of the answers. Therefore, according to an individual request, the respondents had a chance to complete an online questionnaire or one sent by e-mail. However, the final shape of the measurement tool was discussed with the representatives of Polish municipal offices.

The next limitation may be the narrowing down of the study to the public sector. However, the choice of public organisation for the study was deliberate. The literature indicates that crowdsourcing is an important, highly topical, interesting, but relatively new, and poorly structured area of research. There is even a belief that crowdsourcing is a new, exciting research area, which in the next years will be a dynamic and lively area of research (Zhao & Zhu, 2014) – especially in the public sector (Brabham, 2008). Hence, it can be concluded that deliberate narrowing of the research area is justified.

Summing up, the presented research results and their limitations, allow stating the relevance of conducting research on the importance of crowdsourcing for the engagement of employees

of municipal offices. Further research should provide a framework for a better understanding of the importance of crowdsourcing for employee engagement, since the public sector is still outside the principal research in the field of crowdsourcing (Liu, 2017).

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References

- Aalbers, R., Dolfsma, W. & Koppius, O. (2013). Individual connectedness in innovation networks: On the role of individual motivation. *Research Policy*, 42(3), 624-634.
- Afuah, A., & Tucci, C. L. (2013). Value Capture and Crowdsourcing. *Academy Of Management Review*, 38(3), 457-460.
- Albors, J., Ramos, J.C., Hervás, J.L. (2008). New Learning Network Paradigms: Communities of Objectives, Crowdsourcing, Wikis and Open Source. *International Journal of Information Management*, 28(3).
- Bjelland, O.M., & Wood, R.C. (2008). An Inside View of IBM's 'Innovation Jam'. *MIT Sloan Management Review*, 50(1), 32-40.
- Blohm, Ivo, Riedl, Ch., Leimeister, J. M., & Krcmar, H. (2011). Idea Evaluation Mechanisms for Collective Intelligence in Open Innovation Communities: Do Traders Outperform Raters? *Proceedings of 32nd International Conference on Information Systems*.
- Boselie, P. (2010). High performance work practices in the health care sector: a Dutch case study. *International Journal of Manpower*, 31(1), 42-58.
- Brabham, D. C. (2008). Crowdsourcing as a Model for Problem Solving: An Introduction and Cases, Convergence. *The International Journal of Research into New Media Technologies*, 14(1).
- Brabham, D. C. (2009). Crowdsourcing the Public Participation Process for Planning Projects. *Planning Theory*, 8(3).
- Brabham, D.C. (2015). *Crowdsourcing in the Public Sector*, Georgetown University Press 2015.
- Burger-Helmchen T., & Pénin J. (2010). *The limits of crowdsourcing inventive activities: What do transaction cost theory and the evolutionary theories of the firm teach us?* Workshop on Open Source Innovation, France.
- Callaghan, Ch. W. (2016). Knowledge Management and Problem Solving in Real Time: The Role of Swarm Intelligence. *Interdisciplinary Journal of Information, Knowledge, and Management*, 11, 177-199.
- Chanal, V., & Caron-Fasan, M. L. (2008). *How to invent a new business model based on crowdsourcing: The crowdspirit R case*. In EURAM Conference (Slovenia).
- Dontcheva, M., Morris, R.R., Brandt, J.R., & Gerber, E.M. (2014). *Combining crowdsourcing and learning to improve engagement and performance*. CHI '14: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.
- Ederer, F., & Manso, G. (2013). Is Pay-for-Performance Detrimental to Innovation? *Management Science*, 59(7), 1496-1513.

- Fung, A. (2015). Putting the Public Back into Governance: The Challenges of Citizen Participation and Its Future. *Public Administration Review*, 75(4), 513-522.
- Geiger, D., Seedorf, S., Schulze, T., Nickerson, R. C., & Schader, M. (2011). Managing the Crowd: Towards a Taxonomy of Crowdsourcing Processes, *AMCIS 2011 Proceedings - All Submissions*. 430.
- Iddagoda, Y. A., & Opatha, H. H. D. N. P. (2017). Identified Research Gaps in Employee Engagement. *International Business Research*, 10(2), 63.
- Kahn, W. A. (1990). Psychological conditions of personal engagement and disengagement at work. *Academy of Management Journal*, 33, 692-724.
- Kraus, M. W., Piff, P. K., Mendoza-Denton, R., Rheinschmidt, M. L., & Keltner, D. (2012). Social class, solipsism, and contextualism: How the rich are different from the poor. *Psychological Review*, 119, 546-572.
- Leimeister, J.M., Zogaj, S. (2013). Neue Arbeitsorganisation durch Crowdsourcing. *Hans-Böckler-Stiftung Arbeitspapier Arbeit und Soziales*, 287.
- Liu, H. K. (2017). Crowdsourcing Government: Lessons from Multiple Disciplines. *Public Administration Review*, 77(5), 656-667.
- Majchrzak, A., & Malhotra, A. (2013). Towards an Information Systems Perspective and Research Agenda on Crowdsourcing for Innovation, *The Journal of Strategic Information Systems*, 22(4).
- McGuire, M. (2006). Collaborative Public Management: Assessing What We Know and How We Know It. *Public Administration Review*, 66(1), 33-43.
- McKevitt, D., & Lawton, A (eds) (1997). *Public Sector Management: Theory, Critique and Practice*. London: Sage 1997.
- Benington, J., & Moore, M. H. (Eds.) (2010). *Public value: Theory and practice*. Palgrave Macmillan.
- Muñiz, J., & Bartram D. (2007). Improving International Tests and Testing. *European Psychologist*, 12, 206-219.
- Nam, T. (2012). Suggesting Frameworks of Citizen-Sourcing via Government 2.0. *Government Information Quarterly*, 29(1),12-20.
- Nguyen, C., Tahmasbi, N., Vreede, T. de, Vreede, GJ. de, Oh, O., & Reiter-Palmon, R. (2016). *A Definition of Community Crowdsourcing Engagement and Application*. In: D'Ascenzo, F., Magni, M., Lazazzara, A., Za, S. (eds.) *Blurring the Boundaries Through Digital Innovation, Lecture Notes in Information Systems and Organisation*. Springer International Publishing, 283–296
- Osborne, D., & Gaebler, T. (1992). *Reinventing Government: How the Entrepreneurial Spirit is Transforming the Public Sector*. New. York: Addison-Wesley, 1992.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879-903.
- Pritchard, K. (2008). Employee engagement in the UK: meeting the challenge in the public sector. *Development and Learning in Organizations: An International Journal*, 22(6), 15-17.
- Prpić, J., Taeihagh, A., & Melton, J. (2014). *A Framework for Policy Crowdsourcing*. Oxford Internet Institute, University of Oxford - IPP 2014 - Crowdsourcing for Politics and Policy.
- Riemer, K., & Scifleet, P. (2012). *Enterprise social networking in knowledge-intensive work practices: a case study in a professional service firm*. Proceedings of the 23rd Australasian Conference on Information Systems.
- Schneider, D., Moraes, K., De Souza, J.M., & Esteves, M.G.P. (2012). *CSCWD: Five characters in search of crowds*, IEEE International Conference on Computer Supported Cooperative Work in Design.

- Seltzer, E. & Mahmoudi, D. (2013). Citizen Participation, Open Innovation, and Crowdsourcing Challenges and Opportunities for Planning. *Journal of Planning Literature*, 28(1), 3-18.
- Simula, H., & Ahola, T. (2014). A network perspective on idea and innovation crowdsourcing in industrial firms. *Industrial Marketing Management*, 43(3).
- Simula, H., & Vuori, M. (2012). Benefits and Barriers of Crowdsourcing in B2B Firms: Generating Ideas with Internal and External Crowds. *International Journal of Innovation Management*, 16(6).
- Soane, E., Truss, C., Alfes, K., Shantz, A., Rees, Ch., & Gatenby, Mark (2012). Development and application of a new measure of employee engagement: the ISA engagement scale. *Human Resource Development International*, 15(5), 529-547.
- Surowiecki, J. (2004). *The Wisdom of Crowds Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations*, Doubleday.
- Troll, J., Naef, S., & Blohm, I. (2017). *A Mixed Method Approach to. Understanding Crowdsources' Engagement Behavior*. International Conference on Information Systems (ICIS). Seoul, South Korea.
- Vukovic, M., & Bartolini, C. (2010). Towards a research agenda for enterprise crowdsourcing. Leveraging applications of formal methods, verification, and validation, 2010: p. 425-434.
- Wooldridge, B., Schmid, T., & Floyd, S. W. (2008). The middle management perspective on strategy process: contributions, synthesis, and future research. *Journal of Management*, 34, 1190-1221.
- Xarchos, Ch., Charland, M. B. (2008). Innovapost uses Web 2.0 tools to engage its employees. *Strategic HR Review*, 7(3), 13-18.
- Xu, D. Y, Ribeiro-Soriano, E. & Gonzalez-Garcia, J. (2015). Crowdsourcing, innovation and firm performance. *Management Decision*, 53(6), 1158-1169.
- Zhao, Y., & Zhu, Q. (2014). Evaluation on crowdsourcing research: Current status and future direction, *Information Systems Frontiers*, 16(3), 417-434.
- Zuchowski, O. et al., 2016. Internal crowdsourcing: Conceptual framework, structured review, and research agenda. *Journal of Information Technology*, 31(2),166-184.

Appendix

Table A1: Measurement scales

Item	Scale	Composite Reliability	AVE
Crowdsourcing		0.04	0.02
C1	The organisation has introduced platforms to develop ideas about new products or services		
C4	There are financial and non-financial incentives to develop the best ideas		
C5	The firm has evaluation systems to know the effectiveness of the ideas developed		
C7	The firm uses virtual communities to develop new products or services		
Employee engagement		0.85	0.97
EE1	I focus hard on my work		
EE2	I concentrate on my work		
EE3	I pay a lot of attention to my work		
EE4	I share the same work values as my colleagues		
EE5	I share the same work goals as my colleagues		
EE6	I share the same work attitudes as my colleagues		
EE7	I feel positive about my work		
EE8	I feel energetic in my work		
EE9	I am enthusiastic in my work		

Keynotes

Everyone's heard about fake news. What about fake research?

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This presentation deals with the problematic of science nowadays. It addresses the ambiguity of science and also the aims of “evidence based research”, “quantitative research” and the ranking system of publications and scholars.

The Seven Images of a Knowledge-Based Economy

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Gareth Morgan in his seminal book „Images of Organization” gave birth to a new school of management, which is now called ‘postmodernism in management’. Although it opened up a number of research opportunities, it seems that they have not been fully explored. Traditionally Economics research has been dominated with quantitative approaches, and qualitative approaches to describing the economic reality did not serve as an important source of inspiration and creative ideas. This paper aims to use some concepts developed in management science, namely ‘metaphors’ developed according to Gareth Morgan’s school of thought. The metaphors are intended to provide a better understanding of organizations but are not popular as a means to describe the economic landscape. The author has been conducting research and observing the expansion of a KBA since 1996 and, based on his reflection endeavors to present the somewhat different view of a KNBA where the dominant logic is not explained by specific macroeconomic indices such as share of high-value added exports, no. of higher education graduates or R&D government spending. The paper discusses the seven distinct (although sometimes overlapping) images, or perspectives of a KBA which include (1) de-materialization (weightless economy); (2) de-humanization (Industry 4.0, Internet of Things); (3) (4) de-carbonization (green economy); (5) information overload (Economy of Attention), (6) the role of global rankings as drivers of a KNA (not vice versa) and last, but not least, some observations on (7) education systems and the concept of leaning society. Each of the images is provided with some measurement approaches and their implications for further research. A part of the discussions is devoted to the role of the service sector in the economy and its adequacy to describe the economic development in the 21 century. The growth of the service sector was analyzed explained by the three-sector theory formulated by A.G.B. Fisher, C. Clark, and J. Fourastie. The application of the metaphors to understanding the dynamics of national economies and setting research agendas for economic science is discussed in the context of the Forth Paradigm (as described in the book: The Forth Paradigm, Data Intensive Scientific Discovery Microsoft Research 2009).

The Seven Myths and One Golden Rule of the Intellectual Capital

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The research on intellectual capital is at crossroads, due to the failure of measuring and reporting it by using the accounting paradigm. Many people question at this moment if the intellectual capital represents a new economic entity or not. The keynote speech is based on a critical thinking analysis of the concept of intellectual capital, and of the models used for its explanation and measurement. The analysis demonstrates that there are some myths in explaining and using the concept of the intellectual capital, but also a golden rule. The basic idea of this keynote speech is to stimulate debates and ideas for a new paradigm of understanding and dealing with the intellectual capital.

Towards Innovation Union in Europe: Should Innovation Policy be Evidence-based?

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Nowadays, the European Union is challenged in the global arena by emerging economies as well as by the US in terms of developing innovation and capitalizing on knowledge and technology. The need to elaborate long-term strategic visions for the European Union research and innovation system has been recognized in the “Europe 2020” strategy, especially in its innovation union initiative. One of its objectives is to strengthen the European science base and to use scientific evidence in the process of innovation policy-making. The idea of using scientific evidence in order to shape policies aimed at solving society’s problems already existed in ancient times and can be found in the works of Plato, Aristotle, Descartes, among others. Today, an increase in the demand for scientific evidence has been noted, along with questions posed to scientists by policy-makers and by the entire society regarding a range of choices in energy, the consequences of climate change, food safety to health care or social exclusion.

The main objective of this keynote speech is to discuss the direct and indirect effects of the EU innovation policy instruments implemented as an Innovation Union initiative. An emphasis will be put on the tools that promote a stronger European dimension of R&D, including an evidence-based approach to policy making. The speech will be based on the results of the European Union Horizon 2020 project on “Investigating the Impact of the Innovation Union (ISU)”, (H2020-INSO-2014, grant Agreement: 645884).

In search of an Integrated Reporting at the macro level (Regions and Nations). Theoretical foundations and framework proposal

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The advent of the Knowledge economy has dramatically changed the foundations of wealth creation for individuals, companies and nations. Assuming wealth is equivalent to abundance of valuable assets, we realize that in the new context of the knowledge economy wealth is moving from tangible to intangible assets. At company level, traditional accounting books (Balance Sheets and Profit and Lost Accounts) do not provide relevant information on intangible assets, and the way to inform on future wealth creation potential is given to new information system initiatives, such as Integrated Reporting. At the macro level (Regions and Nations) there is a similar problem, but not a similar tentative solution and this research pretends to search the theoretical foundations of an Integrated Reporting at the macro level and to design an

Integrated Reporting specific framework as well. After an introduction, the presentation has two main purposes. First, discovering from the existing relevant literature on sustainable political, economic and social development and on competitiveness, innovation and intellectual capital at the macro level, which are the principles and theories that guide nations' wealth creation in the knowledge economy context. Second, finding out the suitable methodology or framework to enable an in-depth diagnosis of a nation's wealth creation potential foundations. At the same time, this methodology or framework would be the cornerstone of a kind of Integrated Reporting at the macro level (Regions and Nations).

In summary, the research tries to be a first step on the design of an Integrated Reporting framework at the macro level that considers knowledge and other intangibles as the main foundations of competitiveness, innovation and sustainable economic growth, or in other words the main foundations of wealth creation potential.

Challenges of Digital Transformation and Information Overload in Retail Industry

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Abstract: Digital transformation and information overload are two interconnected concepts in a modern economy. As it is an intermediary between producers and customers, retail industry is the most affected by changes in consumer behavior. This means that it has to adapt quickly to changed consumer in a digital world in situation where consumer is confused by quantity of information offered. In this paper, we will give definitions of information overload and digital transformation and we will briefly describe each of them influences the retail industry. The aim of the paper is to outline some ideas that could be further explored and researched in the field of retail management and marketing.

Keywords: digital transformation, retail, consumers, information overload

1 Retail industry role and importance

In national economies, retail industry is an important economic sector. In the EU it is an important source of employment. Furthermore, it significantly contributes to the creation of gross value added and gross domestic product (GDP). Moreover, around fifth of all enterprises are registered for retail (see more in Knezevic et al., 2011; Segetlija, Mesarić, Dujak, 2015). In retail industry in EU, there are about 3.6 million active companies representing 4.5% of gross value added and accounting for almost 9% of EU jobs (European Commission, 2018). Therefore, it is necessary to scientifically study its development and position and the changes brought by various development trends in this economic sector.

Retail is an intermediate economic activity positioned between producers and end-users (consumers), creating value through effective distribution of produced goods and services. As an intermediary economic activity, retail enhances the value of products and services by increasing establish a pleasant shopping environment and raising the shopping atmosphere, reducing risks and making purchasing processes appropriate to consumers' needs while also increasing transaction efficiency in communication and distribution channels (Kent, Omar 2003: 14-17). Indeed, the retail industry is the last chain in supply channels exposed directly to the final consumers. As such, it is heavily exposed to changes in consumer behavior.

Nowadays, retailers observe a rapid change of consumer behavior, which is the outcome of the intensive usage of digital technologies. The ongoing changes are obvious in all phases of purchasing process starting with new ways of collecting information on product and services which is not only driven by retail companies anymore, but by information sharing among consumers via social media as well. In addition, new ways of in-store shopping supported by

digital technology emerge. Moreover, usage of electronic commerce and mobile commerce as substitutes or complements to traditional stores is also brought to the focus of modern retail management.

2 Information overload phenomenon

Due to the intensive use of digital technologies, retailers and marketers nowadays are dealing with consumers who live in an era of information overload. Actually, modern consumer lives in an environment in which too much information is coming from too many sources in too many different forms and, therefore, usefulness of received information is decreasing because an individual cannot efficiently process such a huge amount of information in a timely manner.

There are some synonyms used to describe this phenomenon. Wurman (2001) and Oppenheim (1997) uses the term: information fatigue syndrome, Shenk (1997) describes it as data smog. Eppler and Mennigs (2004) use the term flood of information, while Wilhelm (2000) describes it as data explosion.

As a phenomenon, information overload is driven by digitalization of everything and it refers to the situation when an individual is literally bombed with commercial and other information throughout various information channels (such as: traditional media, electronic media, social media, billboards, posters within the stores, traditional and digital advertises in public transport means, mobile applications etc.). Digitalization is increasing diversity of information and lowers cost of information transfer and the consequence is the rapid growth of information availability (no matter is information unsolicited or requested by an individual).

Zhuang et al. (2011) claim that information overload occurs when information processing requirement exceed information processing capacity. Information overload as an economic problem occurs both on employees' and on consumers' side. Klausegger et al. (2007) proposed sources of the information overload at employee side: (1) increase in internal communication (with colleagues), (3) increased access and utilization of databases, (4) increased utilization of published information (such as journals and newspapers), (5) increase in external communication (e.g. with customers/suppliers) and (6) increased need for documentation and records that have to be maintained.

Zhuang et al. (2011) and Klausegger et al. (2007) outline several outcomes or symptoms of information overload at employees side of the story. Those can be summarized as: inability to use information effectively, implementation of various adaptation methods to the existing situation, increased errors and tolerance to errors, lowered decision efficiency, blurred boundary between work and private life, cognitive strain and stress or even depression and physical illness.

When it comes to a consumer side of the story, a couple of studies confirmed that there is a link between information overload influences the decision making efficiency. Soto-Acosta et al. (2014) and Furner et al. (2016) emphasize that there is inverted U shape curve relationship between information load and information processing both in traditional shopping environment and in online shopping environment as well. Meaning that low information load and excessive information load (i.e. information overload) in shopping prolong decision process and decrease the purchasing intention of a consumer. So if consumer is not informed at all, it will be harder for him or her to make the purchasing decision. On the other hand, if

consumer has too much information during purchasing process, he or she will need more time to decide what to purchase. In addition, if information is too extensive, some consumers will decide not to make purchase at all (see results of the cluster analysis in Stanton and Paolo, 2012).

Furthermore, information overload creates consumer who is (1) less responsive to advertising, (2) easily influenced by social media, (3) exceptionally well informed before entering the retail store, (4) distrustful and less loyal to sales channel, company, store or a product brand, (5) frustrated with numerous marketing messages, especially those transmitted directly on a personal level. On the other hand, numerous examples are showing that, in the situation of information overload, some consumers are becoming more responsive to an instant fascination with the offered products or services. Therefore, lifecycles of products shorten rapidly and there are numerous examples showing this trend. Therefore, we can say that digital technology creates a number of challenges that a fashionable retailer must analyze and adapt to in order to create and preserve its competitive advantage.

3 Digital transformation as a necessity in retail industry

In order to adapt to such consumer, retail industry is undergoing through digital transformation. The concept of digital transformation refers to the transformation of organization and business processes based on the intensive application of information and communication technology.

Spremić (2017, 53) elaborates the concept of digital transformation of business and debates that it relates to the continuous application of digital technologies. And those digital technologies are aimed at designing innovative business strategies and disruptive business models, applying progressive business concepts, new ways of management and leadership with the goal of creating better products and services, and improving consumer experience, i.e. in order to create a new value for the customer.

In addition, Knežević and Knego (2012) point out that over the past 30 years there has been an accelerated development of information and communication technologies (ICT) and that ICT brings major changes in the daily operation of retail companies. Moreover, ICT changes the way that end consumers (who are directly in touch with retailers) behave. Also, they emphasize that in the retail industry, in recent times, ICT is viewed as a strategic component of the business system, which can significantly improve the differentiation compared to competitors, and generate revenue growth and increase added value for consumers.

There are several areas of digital technology that already have or that soon will have an important impact on further development of retail industry. Namely: (1) electronic commerce, (2) mobile commerce, (3) social networks and social media, (4) location-based commerce and geoinformation systems, (5) radio frequency identification, (6) intelligent and integrated consumer profiling systems and retail mix planning systems, (7) additive technologies.

It is necessary to emphasize that contemporary literature highlights two directions of digital transformation in retail industry. One refers to the complete abolishment of traditional channels of communication, sales and distribution, with the establishment of new ones which are digitally-based. This direction of the digital transformation can be described as a digital revolution. It is characterized by the abolition of some parts of trade channels (so-called

disintermediation process), but also it is characterized with the emergence of new intermediaries in trade channels (so-called reintermediation process) (Turban et al., 2015, 145).

The second direction of the digital transformation is, in fact, the implementation of ICT into existing business processes in order to increase efficiency, reduce costs, improve competitiveness and increase consumer satisfaction. This direction is called digital evolution. It implies the application of digital tools in the operation of existing trading channel participants, and here is often discussed about the digitization of business processes within existing retail companies and the implementation of the omnichannel approach to consumers (see Brynjolfsson, Hu, Rahman, 2013; Piotrowicz, Cuthbertson, 2014; Juaneda-Ayens, Mosquera, Sierra Murillo, 2016).

4 The emergence of new research topics in retail marketing and management

Both digital revolution and digital evolution have different impacts on:

- (a) consumers who become well informed, more demanding, more critical, more open to different communication channels and begin to demand a fully personalized approach,
- (b) supply chains that need to become more integrated in order to quickly create value for a changed consumer market and to become as flexible as possible, but also more reliable in creating value on the way from raw material to end consumer in an environment of shortened product lifecycles,
- (c) producers by fostering them to produce high quality products with a high degree of personalization and to organize faster delivery to such demanding consumers,
- (d) the retail industry in general, which is restructured on the basis of the emergence of new intermediaries or on the basis of the implementation of multi-channel (omnichannel) approaches to consumers.

Therefore, new research questions emerge which should be addressed in future research studies in retail management and marketing field. Some of them are:

- whether the digital revolution or digital evolution dominates in retail industry
- which digital technologies is digital (r)evolution in retail is based on
- how digital technologies affect consumers, supply chains and retail industry in general;
- can connection between digital (r)evolution and the other development trends within retail industry (internationalization, concentration, and networking of companies) be seen
- are there differences in digital transformation processes between companies (micro-level) and between countries or regions (macro-level)
- *and, finally, does digital (r)evolution changes consumer behavior or vice versa.*

References

- Brynjolfsson, E., Hu, Y. J., Rahman, M. S. (2013), Competing in the age of omnichannel retailing, *MIT Sloan Management Review*, 54 (4), 23–29
- Eppler, M. and Mengis, J. (2004), The concept of information overload: a review of literature from organization science, accounting, marketing, MIS, and related disciplines, *The Information Society*, 20(5), 325-344.
- European Commission (2018), *Retail services*, available at: https://ec.europa.eu/growth/single-market/services/retail_en (accessed on 11th May 2018).
- Furner, C.P., Zinko, R., Zhu, Z. (2016), Electronic word-of-mouth and information overload in an experiential service industry, *Journal of Service Theory and Practice*, 26(6), 788-810.
- Juaneda-Ayensa, E., Mosquera, A., Sierra Murillo, Y. (2016), Omnichannel Customer Behavior: Key Drivers of Technology Acceptance and Use and Their Effects on Purchase Intention, *Frontiers in Psychology*, 7, 1117
- Kent, T., Omar, O. (2003), *Retailing*, Palgrave Macmillan
- Klauegger, C., Sinkovics, R.R., Zou, H.J. (2007), Information overload: a cross-national investigation of influence factors and effects, *Marketing Intelligence & Planning*, 25 (7), 691-718.
- Knego, N., Knežević, B. (2012), Ključni trendovi u distributivnoj trgovini, u: Knego, N., Renko, S., Knežević, B. (ur.), *Mijo Mirković – Trgovina i unutrašnja trgovinska politika* (pretisak s komentarima), Ekonomski fakultet Sveučilišta u Zagrebu, 261-280 (in Croatian).
- Knezevic, B., Renko, S., Knego, N. (2011), Changes in Retail Industry in the EU, *Business, Management and Education*, 9(1), 34-49
- Oppenheim, C. (1997), Managers' use and handling of information, *International Journal of Information Management*, 17(4), 239-428.
- Piotrowicz, W., Cuthbertson, R. (2014), Introduction to the special issue information technology in retail: toward omnichannel retailing, *International Journal of Electronic Commerce*, 18 (4), 5–16
- Segetlija, Z., Mesarić, J., Dujak, D. (2015), Distributive Trade's Significance in National Economy, *LogForum*, 11 (3), 217-225
- Shenk, D. (1997), *Data Smog: Surviving the Information Glut*, HarperEdge, San Francisco, CA.
- Soto-Acosta, P., Molina-Castillo, F.J., Lopez-Nicolas, C., Colomo-Palacios, R. (2014), The effect of information overload and disorganisation on intention to purchase online: The role of perceived risk and internet experience, *Online Information Review*, 38(4), 543-561.
- Spremić, M. (2017), *Digitalna transformacija poslovanja*, Ekonomski fakultet Sveučilišta u Zagrebu (in Croatian).
- Stanton, J.V., Paolo, D.M. (2012), Information overload in the context of apparel: Effects on confidence, shopper orientation and leadership, *Journal of Fashion Marketing and Management*, 16 (4), 454-476.
- Turban, E., King, D., Lee, J.K., Liang, T.P., Turban, D.C. (2015), *Electronic Commerce: A Managerial and Social Network Perspective* (8th Edition), Springer
- Wilhelm, K. (2000), Ground zero for a data explosion, *Far Eastern Economic Review*, 163(46), 40-42.
- Wurman, R.S. (2001), *Information Anxiety 2*, Macmillan, Indianapolis, IN.
- Zhuang, L., Qiu, Y., Peng, L. (2011), Is it the more the merrier?: An exploratory study into the growing problem of information overload, *Journal of Technology Management in China*, 6(1), 69-83.

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