Learn PAd : Collaborative and Model-based Learning in Public Administrations

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Abstract. In modern society public administrations (PAs) are undergoing a transformation of their perceived role from controllers to proactive service providers. PAs are today under pressure to constantly improve the quality of delivered services, while coping with quickly changing context (changes in law and regulations, societal globalization, fast technology evolution) and decreasing budgets. As a result civil servants delivering such services to citizens are challenged to understand and put in action latest procedures and rules within tight time constraints. The European project Learn PAd copes with this transformation by proposing an e-learning platform that enables process-driven learning and fosters cooperation and knowledge-sharing. The platform supports both an informative learning approach, based on enriched business process (BP) models, and a procedural learning approach, based on simulation and monitoring, while relating them as well to learning objectives and key performance indicators.

1 Introduction

The Public Administration (PA) sector in modern society is characterized by the need to continuously improve the delivery of already provided services as well as to introduce new services for both citizens and companies. The adoption of the European Interoperability Framework [1] challenges the PAs from the European member states to cope with several and interconnected procedures, which are often documented and modelled in term of Business Processes (BPs).

A BP describes a collection of activities, messages, and forms that the PAs have to elaborate in order to produce a service to their end-users (i.e citizen, company, or other PAs). Such services are usually articulated in three main phases: i) activation (i.e. request, documentation); ii) processing while performing activities that add value (i.e., checks), or producing evidences: in both these cases the activities use resources (i.e., humans, information, structures); iii) release of

a set of produced artefacts as output (e.g. permission, licenses, or rights). Furthermore, it is evident that a BP of a PA must also comply with all regulations governing the subject of the service.

Designing and understanding BPs for PAs is a complex, interdisciplinary, and time consuming task that often involves judgements based on domain knowledge and experience. From the point of view of a civil servant, complexity is also raised by the fact that BPs typically include several alternative scenarios, many of which are seldom activated and may be thus not well understood. Moreover in most of the cases a collaborative effort involving several PA offices is required to fulfill BP objectives. Finally the introduction of new regulations, or their frequent modifications, results in the intertwined modification/deletion of already established BPs, or it can lead to the creation of BPs that were not originally considered. In short BPs in PAs require that civil servants acquire a complex knowledge [2].

Such knowledge is necessary both for accomplishing the required tasks, and to determine what are the tasks to be executed in presence of uncertainty. The management of such a knowledge is challenging per-se. Civil servants deal with heterogeneous information usually learned from previous engagements. In some cases, they can access to insights from prior projects, where notes for subsequent process steps are scattered among manifold "knowledge containers" spanning from the personal memory/notes, to some official information systems. Nevertheless, it is often difficult to use such pieces of "best practice" in a coordinated manner that can take into account both the documents content and the document context (i.e. the creation situation, the potential usage situation). Therefore civil servants are never done with learning how to carry out their tasks. This is one of the major critical issues that modern PAs have to cope with when transforming their regulation framework in order to improve efficiency and effectiveness.

The Learn PAd project (see Section 5 for details) investigates means for merging the activities modeled in a BP and the context behind, so to collaboratively organize knowledge archives that could support civil servants in learning and mastering the complexity of PA processes. In particular, we promote the engagement of civil servants in learning activities at different times, following different paradigms, and by different means, i.e., by fostering informative learning paradigm (i.e. from the BP models and their related material), but also by promoting the same civil servants as "prosumers" (providers/consumers) of the learning materials.

The rest of the paper is organized as follows: Section 2 envisions a methodology supporting the definition of both BP models, and their associated learning artefacts in PAs. Section 3 presents the overall strategy followed in the project work-plan. Section 4 discusses both the challenges, and the perspectives expected by the Learn PAd project; finally Section 5 concludes the paper by reporting a synthetic outline of the project, the founding schema, the consortium, and the key-people involved.

2 Models and Contents Production Process

A service offered by a PA can be fully carried out within an administration, or may require information held by other institutions, or may be delivered in collaboration with other PAs. In any of these cases the activities that a PA has to perform are strictly guided by rules emphasizing the recognition of the legality and regularity of the administrative work. In addition to the formal obligations, an important characteristic in PA processes is the presence of internal procedures resulting from the establishment of "habits": for example checks or obligations that in the past were required by the official regulations and were afterwards revoked, but are still locally enforced. These internal procedures are frequently part of tacit knowledge of a PA. They often result elusive to highlight and to learn when they are benign, but they are particularly difficult to eradicate when they are mere bureaucracy. In any of these cases, they make the work of new employees difficult. The possibility to collaboratively model and discuss PA processes, in order to document them, can help the training of new employees, and can facilitate the reorganization of offices and the removal of unnecessary procedures.

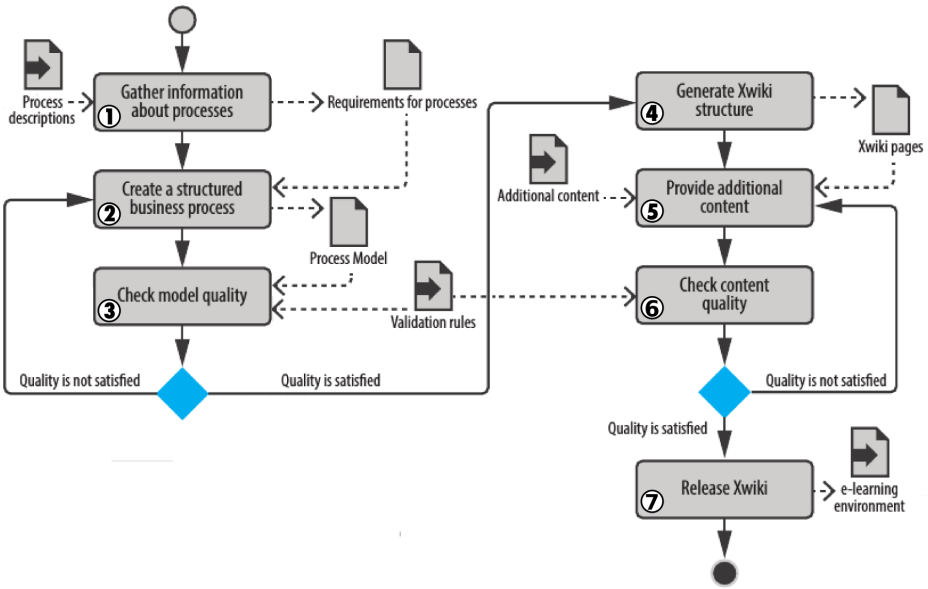

Fig. 1. Models and Contents Production Process

The Learn PAd project envisions a methodology for the collaborative modelling and learning of BP-oriented procedures in PAs. Figure 1 sketches the main steps about the models and contents production process. According to this vision, the organization of a set of activities in a PA starts with the identification

of the formal set of laws, rules and procedures regulating them (①). All this information is explicitly structured and codified using a graphical BP notation (②) and is possibly linked with other artefacts modelling information objects (e.g. documents and data), organizational structure business motivation (e.g. policies, strategy, goals, objectives and influencers) [3].The models and their relations are checked in order to assess their structural and semantic quality (③); if these checks fail, further iterations on the modelling phase are requested, else the models are the input of an automatic synthesis process that structures and populates the e-learning platform supporting wiki-like facilities (i.e. the Learn PAd platform – ④). Note that most information about a PA process comes from sets of regulations in natural language (e.g. laws, and procedures that cannot be modified). Thus often quality issues on the model representation (e.g. non termination of the BP, or deadlock) are due to alternative interpretations of such regulations.

The models structured as a collection of interlinked wiki pages provide a valuable source of information grasping the BP objectives and context. In this sense, the Learn PAd platform enables informative and process-driven learning, as the civil servants can browse and access the information codified in the models. The wiki-like representation of the BP structure, its data, and its business rules, enable communities of civil servants to collaboratively develop documentations, hints, people to contact (⑤). Moreover it fosters the continuous upgrade of such information directly by the personnel working within each BP. In other words, the platform fosters cooperation and knowledge-sharing among civil servants. For each new contribution, further quality procedures and check about the contents produced are enabled (⑥); for example in order to support the identification of potential ambiguities or contradictory documentations. If no issues are raised, contents are released on the platform becoming part of the additional documentation of a process (⑦).

In some case, the collaborative development of documentations could reveal unexpected behaviour or desirable improvements. There, it is possible to take advantage of the semi-formal representation of the BP. Specifically, modellers can be notified with a bottom-up feedback about the highlighted problem; when a fresh version of the global specification is released, the related documentations can be preserved by navigating and comparing the two BP versions.

3 Overall Strategy and Work Plan

Main aim of the project is to build a collaborative and BP-based e-learning platform targeted at supporting training of civil servants. Following this objective, the Learn PAd consortium identified five major solution dimensions: *Model Based Learning* where a set of model kinds, and their interrelations, are the key abstractions used in order to represents the different aspects of an organization; *Collaborative Content Management* referred to a collection of wiki pages organized in accordance to the structure of corresponding models; *Content and Models Automatic Assessment* for both the models and their associated docu-

mentation produced by civil servants; *Simulation Based Learning Support* that enables civil servants to experiment collaboratively their acquired knowledge; *Monitoring and KPI for engaging learners* where indicators are derived and monitored in order to assess both civil servants, and organizational learning.

These solution dimensions are investigated within four work packages (i.e. WP3, WP4, WP5, WP6) mainly conceived to enhance the research with the area of technology-enhanced learning. These work packages leverage on the activities from other three work packages (i.e. WP1, WP2, WP7) enabling the engineering of the Learn PAd platform. The project validates its achievements using two demonstrators (i.e. WP8). Finally, dissemination and management activities are the focus of the remaining WPs (i.e. WP9, WP10).

In the following we report more details for each work package in Learn PAd.

WP1: Requirements Analysis is conceived as the very first interaction point of the project where all partners meet in order to define and to elicit their needs and their vision for the e-learning platform that will result from the project. Specifically, the whole consortium discusses the requirements from research, methodological, technical, architectural and user perspectives.

WP2: Learn PAd Platform designs the high level architecture for the whole Learn PAd platform and it shapes the strategy for the integration of the various components. It also provides the design of the core functionalities of the collaborative framework to which all the tools developed by WP4, WP5, WP6 can be plugged in. Moreover the core of the collaborative framework relies on the data metamodel resulting from WP3 and WP5.

WP3: Approaches Enabling Model-Based Learning analyses, specifies, and defines the domain-specific models and meta-models that are needed to be adopted for the management and learning of business processes and their context. Specifically, it investigates on adequate means for automatically relating BP-notations such as BPMN [4], and other model kinds representing either the organization of the PAs or learning aspects.

WP4: Models and Contents Quality Assessment investigates on the quality assessment of the BP model specifications, and its related learning contents. The quality assessment will be based on both formal verification, and natural languages processing techniques. The former will focus on proper approaches assessing the satisfaction of relevant properties by defined BP models. The latter will include mechanisms to check if the text within the learning content referring to the elements of a model is *consistent* (e.g. not contradictory, issuing potential ambiguities, etc.) with respect to the model itself.

WP5: Collaborative Content Management deals with the collaborative management of learning contents, including their production and fruition. Specifically the WP is designed around the definition of ontologies providing a shared understanding of learners, contents and KPI. It also leverages on automatic reasoning in order to measure the success of learning, as well as cooperation and content production. This work package fosters the development of a performance culture by explicitly referring to KPIs as means for assessing how learners engage in learning, and improve their competence by means of the platform.

WP6: Simulation Based Learning researches on the design and the construction of a simulation environment where learners are engaged in training activities. The simulation engine will support both the software emulation of the involved parties, and the provisioning of dedicated means for gathering learners willing to train on the business process by interacting with other learners.
WP7: Coordination Activities Supporting Integration is a technical work package prescribing the guidelines for the development and the integration of the software provided by the other work packages.
WP8: Demonstrators aims at demonstrating applicability, acceptance and effectiveness of the overall Learn PAd platform. The WP leverages on the results from the WPs 1-6 from two different PAs, each one providing and highlighting different aspects.

The first case concerns the administrative procedures related to the participation to a European research project. This case is demonstrated in the administrative departments at University of Camerino. It is conceived to engage different partners in the definition of BP models and BP documentation, but without crossing the border of that PA.

The second case addresses a more complex inter-organizational scenario involving several PAs. Specifically, it refers to the activities that the Italian PAs have to put in place in order to allow entrepreneurs to set up a new company (i.e. Sportello Unico Attività Produttive – SUAP). This demonstrator is run under the support of Regione Marche PA, which partially regulates the activities in SUAP, and it also includes a stable school for PA employees.
WP9: Dissemination and Exploitation deals with managing all activities including dissemination, exploitation, standardization undertaken throughout the project.
WP10: Management includes all management tasks (e.g. budgeting, project staffing, planning, quality assurance, etc.).

4 Challenges and Perspectives

For each of the five main solution dimensions presented in Section 3, the Learn PAd project deals with challenges and perspectives overcoming the current state-of-the-art in technology-enhanced learning.
Model Based Learning : The more evident perspective promoted by the Learn PAd project is to adopt models (and their graphical representation) as the basis for organizing knowledge and training people in PAs. In fact models have been used more and more to represent different dimensions of an organization; what Learn PAd proposes is a systematic way to automatically derive and organize e-learning artefacts from such models; thus a platform for Model Based Learning supporting off-line learning by consulting and commenting contents related to specific topic, and learning-by-doing by simulating the BP activities.

A challenge with respect to the current state-of-the-art in the field of Model-Driven Engineering concerns the proposition of means for the homogeneous linking of orthogonal aspects. For instance from the BP notations towards several

other model kinds that are referred in the domain of PA (i.e. case, organization, competency, business motivation, data). Only an explicit formulation of those interrelations can enable coherent cross-model analysis, and the automatic synthesis of e-learning artefacts.

This solution dimension is mainly investigated in WP3, and WP5.

Collaborative Content Management : The main innovation brought to the Collaborative Content Management dimension in e-learning is to have an asynchronous learning platform where civil servants are both learners and instructors and contribute to create a shared knowledge. Like in a wiki, the platform supports the provision from some power-brokers of tutorial/learning material that is updated and commented by civil servants in a collaborative way. As introduced above the underlying structure of the platform is automatically derived according to precise metamodel specifications and reflects the structure of different model kinds adopted and their interrelations.

In addition, the platform refers to complex ontologies in order to classify learners and contents, and also in order to infer learning needs for the civil servants. Indeed, the innovation about this dimension also concerns the possibility to provide context-based recommendation of both contents and social profiles (e.g. a set of competent colleagues which may provide help).

This solution dimension is mainly investigated in WP5 and partially in WP3.

Content and Models Automatic Assessment : The platform is including automatic verification techniques with reference to both stored models and contents. The research along this dimension leverages formal verification techniques that are used to highlight potential issues in BP and related specifications. Since Learn PAd encourages collaborative work on documenting models on-line with new learning artefacts, the perspective of an automatic support for contents production assessment is particularly appealing. Instead of pre-defined structured information, unstructured information in natural language that is related to the models (comments, annotations, etc. in the platform) need to be analysed. The challenge is that quality for the contents produced by the civil servants is addressed by investigating advanced Natural Language Processing techniques [5]. In this respect, textual analysis mechanisms rely on the definition of rigorous specification (i.e. metamodels and weaving models) for relating the models and with contributed textual material in order to highlight possible inconsistencies or mismatches.

This solution dimension is investigated in WP4.

Simulation Based Learning Support : Another perspective pursued by the Learn PAd project focuses on highly interactive media-intensive learning environments. The challenge is to enhance traditional training methods by means of simulation exercises. In addition, the simulation environment of Learn PAd includes a BP execution engine supporting the behavioural emulation of the involved parties in the process. Also, in this context the simulation may suggest some “interesting” paths in a BP, leveraging research in model-based testing approaches enabling the detection of critical branches/paths [6][7], or seldom

activated during actual BP engagements (i.e. paths where civil servants are supposed to be less skilled).

Along this dimension, Learn PAd investigates topics on collaborative simulations, and *gamification*, which are currently considered as promising approaches to learning by many communities in the field [8][9][10].

This solution dimension is investigated in WP6.

Monitoring and KPI for engaging learners : The Learn PAd project envisions KPIs as specifically tailored to reveal knowledge resources and specific capabilities of learners. For example, a perspective foresees individual KPI profile as a mean for learners to identify and to communicate with relevant peers/experts in order to explore collaboration opportunities and enhance their learning process.

The challenge on the KPI dimension rises from their formulation and usage. The research in Learn PAd aims at combining the knowledge maturing scorecard approach which measure the achievement of learning goals, with the Business Motivation Model that explicitly represents the goals and objectives of an organization (i.e. the PA). Instances of the individual KPI profile rely on data from the activities performed within the platform: either with respect to the quantity/quality of learning artefacts produced, or with respect to the results from the sessions executed in the simulation environment.

The Learn PAd project investigates the track of activities on the platform by means of multi-source monitoring facilities grounded on research about the Events-Driven software architecture pattern[11]. In this respect the challenge is to conceive adaptive approaches that are able to correlate auditing data and inferring complex events so that to be used in order to compute the aggregated data from an instance of an individual KPI profile.

This solution dimension is manly investigated in both WP5, and WP6.

5 Learn PAd at a Glance

Project Acronym: Learn PAd
Project Name: Model-Based Social Learning for Public Administrations
Official Project Web-Site: http://www.learnpad.eu
Source of funding: European Commission : EU FP7-ICT-2013-11 / 619583
Overall Total Budget: Total cost: € 3.532.993 (EC contribution: € 2.635.000)
Duration: 30 months (from the 1^{st} Feb. 2014 to the 31^{st} Jul. 2016)
Consortium:

Beneficiary Name	Short Name	Country
Consiglio Nazionale delle Ricerche (coordinator)	CNR	Italy
BOC Asset Management GmbH	BOC	Austria
LINAGORA GSO	LIN	France
No Magic Europe	NME	Lithuania
Regione Marche	MAR	Italy
University of Applied Sciences and Arts Northwestern Switzerland	FHNW	Switzerland
University of Camerino	UNICAM	Italy
University of L'Aquila	UDA	Italy
XWiki SAS	XWIKI	France

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Technical Leader : Guglielmo De Angelis (CNR) **Project Secretary :** Daniela Mulas (CNR)
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