

Modeling Organizational Potentials Using the Dynamic Nature of Capabilities

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Abstract. Organizational transformation in dynamic environments may be addressed using an approach based on the concept of capability. The aim of this thesis project is to tackle existing disadvantages that organizations are unaware of or missing business opportunities due to unoptimized design. Design Science is employed to elicit requirements and develop a method that assists the identification of desired organizational capabilities and outdated capabilities. This will enhance the value generating and supporting capabilities by introducing a new typology and exploring the factors affecting the introduced capability types. The developed artifact will also be supported by a modeling tool using the ADOxx metamodeling development platform and tested in a real use case.

Keywords: Capabilities, Dynamic capabilities, Enterprise Modeling, Organizational dynamism.

1 Introduction

Since ancient Greek philosophers, the concept of change has always been significant in understanding world mechanics. “Ta panta rhei”, a famous aphorism, which is attributed to Heraclitus of Ephesus, means everything flows. This may sound as a simplified way to describe change, however, Heraclitus’s philosophy can be summarized with an example he used. His insistence on constant change being the essence of the universe is depicted in the following statement: “No man can ever step into the same river twice”. According to Heraclitus, it is not only the river that changes, since the moving water is obviously constantly replaced, it is also the person stepping into the river that has also changed since the first step. Everything flows, and is constantly changing. This example describes the environmental dynamism existing in all aspects of the world with an astonishing accuracy. Heraclitus’s philosophy still applies in the majority of modern world aspects, organizations being no exception.

Organizational dynamism is one application of this viewpoint that is being widely researched up to date. Organizational change or transformation is the result of organizational dynamism that is conceived as interacting forces, which may be internal or external to an organization. Nowadays, there is a clear and present need for a greater depth of understanding, not only of organizations, but also of organizational change [1].

The process of organizational change suggested by [2] consists of several steps, the first of which is the establishment of a sense of urgency. This requires that an organization is already aware of a required change, yet, in practice, this is not always the case. Missing opportunities are often encountered because an organization was not aware of a missing capability or a loss-generating capability it possessed. For example, if an educational organization is unaware of updates in state-of-the-art domain knowledge and has not updated its curriculum accordingly, the potential to teach outdated knowledge to its students exists, which can be considered as a negative capability for the organization. This negative aspect of capabilities has not been researched up to date.

Taking into consideration the fact that the rate at which the external organizational environment changes is constantly accelerated due to factors like technological progress, organizations can no longer anticipate or predict external changes and be prepared for them. On the contrary, organizations nowadays are playing catch-up, and the distance can only be amplified in the future since their rate of change is significantly slower than their environment's [1]. As a result, the number of unexploited advantages or loss-generating disadvantages of whose existence an organization is unaware of, can only increase in the future as well.

A method facilitating the identification of these types of phenomena using a capability approach and guiding their transition to value-generating capabilities is expected to be used as a tool in the constant organizational change process.

The rest of the paper is structured as follows. Section 2 presents the aim and goals of the thesis project. Section 3 provides a brief overview of the theoretical background of the project. Section 4 describes the methodology selected for the project. Section 5 briefly states the progress of the thesis project. Section 6 presents concluding remarks.

2 Research aim

The aim of this thesis project is to tackle factors affecting organizational change adopting an approach based on the concept of capability. The contemporary approaches to organizational design mostly address the positive aspects of an organization that produce value and sustain organizational advantages, but apart from these there are also negative aspects that are often neglected. [3] explored the commonalities in purpose of implementing the concept of capability in existing frameworks. An agreement exists that the concept of capability in existing frameworks facilitates the definition and bundling of discrete functional organizational abilities and/or outcomes. The current state-of-the-art of Enterprise Modeling (EM) methods and frameworks that address organizational structures may be efficient, yet, not optimal for this task compared to a method designed to address specifically this area.

The capability approach is a convenient way to address this issue. Addressing this research project using alternatives like process or service approaches may have also been possible, nevertheless, the association of the concept of capability with goals, processes, context elements, actors and resources [4], suggest its higher suitability for the given problem. In addition, in this project, a new classification of capabilities is intro-

duced. It is mainly based on the significant association between organizational capabilities and goals. [5] state that the definition of a goal initiates the questions “What are we trying to achieve?” and “What are trying to avoid?”. This statement concerns business process goals but a generalized version of this statement can be applied on organizational goals. Goals can be perceived as an organization’s desirable states that it aims to achieve and problems as undesirable states that it aims to avoid.

The goal of this thesis is to:

1. Develop a method aimed to identify existing organizational advantages or disadvantages using the capability approach and facilitate organizational transformation by guiding the capability transition process.
2. Develop a tool aimed to support the abovementioned method.

3 Theoretical background

3.1 Capabilities

The concept of capabilities has been widely discussed in the literature and a wide range of definitions exist, based on the researchers’ point of focus considering the nature of capabilities. The various definitions of capability have been proposed as follows:

- Resource: “A capability is an organizationally embedded firm-specific non-transferable resource that enhances the productivity of the firm’s other resources” [6]
- Ability: “The ability of an organization to perform a coordinated set of tasks, utilizing organizational resources, for the purpose of achieving a particular end result.” [7].
- Ability and capacity “A capability is the ability and capacity that enables an enterprise to achieve a business goal in a certain context.” [8]

The above definitions indicate that there is no agreement on the definition of the term capability. This lack of agreement is also evident in the contribution of [3], where a variety of different capability definitions are presented and reviewed. Therefore, any discussion about capabilities should start with a clarification of the concept, as advised by [9].

While noting that there is no clear and unanimously accepted capability definition, a common theme existing in all definitions is the association to a specific organizational context. There exists argumentation against this attribute in the research literature arguing about the nature of capability. Adopting a general viewpoint on capability may be problematic considering what a capability is or is not [10], however, as long as the domain of organizational change is concerned, the association between capabilities and turbulent environments is worth researching. Delimiting the approach of this thesis project to organizational capabilities fulfills the necessary requirements for taking their significant association to context for granted. However, as long as this thesis project is concerned, capabilities are defined as:

An organization possesses a specific capability when a set of resources is structured in such a way, so that the potential to fulfill a specific goal in a specific context is enabled.

It should be noted that the term *resources* refers to both tangible (e.g. hardware, buildings) and intangible (e.g. information, organizational structures) elements of value to an organization.

3.2 Dynamic capabilities

The concept of capabilities is also often encountered in association to the dynamic environment they exist in. This resulted in the concept of dynamic capabilities. Organizational capabilities are, therefore, classified as operational or dynamic, the former being the type that enables a firm to perform an activity on an on-going basis using more or less the same techniques on the same scale to support existing products and services for the same customer population [11], while the latter is discussed below in detail.

The term “dynamic capabilities” is defined with many different ways in the literature, based on researchers’ different approaches and points of focus.

- Ability: Dynamic capabilities are defined as the ability to “integrate, build, and reconfigure internal and external competencies to address rapidly changing environments”. [12].
- Orientation: “A firm’s behavioral orientation constantly to integrate, reconfigure, renew and recreate its resources and capabilities and, most importantly, upgrade and reconstruct its core capabilities in response to the changing environment to attain and sustain competitive advantage.” [13].
- Process: “The firm’s processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match and even create market change’ and ‘the organizational and strategic routines by which firms achieve new resources and configurations as markets emerge, collide, split, evolve, and die.” [14]
- Capacity: “The capacity of an organization to purposefully create, extend or modify its knowledge-related resources, capabilities or routines to pursue improved effectiveness.” [15].
- Creation/Design: “The creation of difficult-to-imitate combinations of resources on a global basis that provide a firm a competitive advantage.” [16].
- Mechanism: “The mechanism for winners to survive in the next generation despite the environmental changes.” [17].

Derived from the field of strategic management, and, in particular, as a response to the Resource-based view (RBV) theory, the concept and theory of dynamic capabilities attempts to bridge the gap between the static resources suggested by RBV and the dynamism existing in organizational environments.

Despite the differences that exist in the above definitions the common theme in all of them is change. The difference between operational and dynamic capabilities lies in the fact that operational capabilities directly provide value for the given organization, while dynamic capabilities provide change to the operational capabilities pool.

The definition of the concept of capability is not yet agreed upon. Dynamic capabilities, as a concept, as indicated by the above definitions, is generating more contradicting definitions. This is probably derived from the inclusion of the term “dynamic”. The term “dynamic”, referring to change, has a double meaning. It means both something “is always active or changing” and “something that causes change or growth in something else” [18]. In other words, the term dynamic refers to both something that is being changed and something that is provoking change in something else. As a result, this can be the source of confusion concerning capability research. This thesis project aims to avoid confusion, therefore, eschews the term “dynamic capability”. Existing knowledge base on dynamic capabilities is not rejected, however, in this project, the term “strategic capability” will be used instead of the former.

Nevertheless, organizational dynamism is undeniably an existing phenomenon. Capabilities, being a part of the organizational structure, are affected by changes in a turbulent organizational environment. In addition, what has been made clear by the above-mentioned definitions is that there are different levels of capabilities. The lowest level of capabilities consists of operational, also named as first order or ordinary capabilities and the higher levels comprise of all the other capabilities, including capabilities that manage resources in order to enable ordinary capabilities. Various researchers have addressed this issue and suggested various typologies. For example, [19] classified capabilities based on their association to static, dynamic or creative activities. A summary of these typologies has been properly presented in [20]. Table 1 below consists of their findings along with additional typologies identified through the literature review conducted as the initial step of this thesis project. From left to right, lower to higher capability types are presented along with the research paper they have been introduced in.

Table 1. Comparing capability typologies (adapted from [20])

| | | | | |
|------|--------------------------|--|---------------------------|--------------------------------|
| [19] | First category | Second and third categories | Meta-capabilities | Ad infinitum meta capabilities |
| [21] | First-order capabilities | Second-order capabilities | | |
| [22] | Zero-level capabilities | First-order capabilities | Higher order capabilities | |
| [23] | Substantive capabilities | Dynamic capabilities | | |
| [9] | Classical capabilities | Radical/Integrated/Routinized dynamic capabilities | | |
| [20] | Resource base | Incremental/Renewing capabilities | Regenerative capabilities | |

3.3 Capabilities and Enterprise Modeling

EM has been used in several ways to depict organizational capabilities and organizational change. The depiction of organizational capabilities using EM is called capability modeling. There exist stand-alone capability modeling methods e.g. VDML (Value Delivery Modeling Language) [24] and CDD (Capability-Driven Development) and its application on the CaaS (Capability as a Service in digital enterprises) project [8].

Several popular Enterprise Architecture frameworks include the concept of capability in their official notation through the inclusion of capability viewpoints. The most popular enterprise architecture frameworks that include capability modeling are (i) DoDAF (Department of Defense Architecture Framework) [25], (ii) NATO Architecture Framework (NAF) [26] which is based on Ministry of Defence Architecture Framework (MODAF) [27] since version 3, and (iii) Archimate [28].

There have also been research contributions that provide suggestions on how to model the dynamic nature of capabilities based on existing modeling methods like i* [29] or Capability Maps [30] or introducing new notations like Fractal Enterprise Model (FEM) [31] and CODEK [32] to include the element required to capture how a capability can change or be changed in dynamic environments.

4 Methodology

Design science research [33] is a research paradigm “that seeks to consolidate knowledge about the design and development of solutions, to improve existing systems, solve problems and create new artifacts” [34]. Therefore, it has been selected as an appropriate research paradigm for the given method developing thesis project. In particular, this project will follow the Design Science Research guidelines suggested in [35]. Their framework suggests following the steps shown in fig. 1 below.

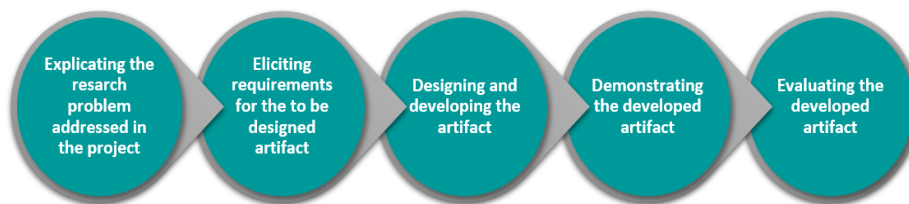


Fig. 1. Overview of activities suggested in method framework for design science research (Adapted from [35]).

4.1 Explicate problem

According to [35], during the first activity suggested in their framework, it is required that a practical problem is investigated and analyzed thoroughly. This task is succeeded by a precise formulation and justification of the given research problem. The purpose of this activity is not only to identify a problem, but also show its significance on some global practice. [36] suggests that a thesis project, like any other research project,

should initiate by positioning the project amidst its relevant fields and concepts in order to facilitate deriving its contribution.

This thesis project lies between the field of organizational change and EM. In particular, it is associated to capability modeling, which is a subset of EM and organizational change. Fig. 2 below depicts this association.

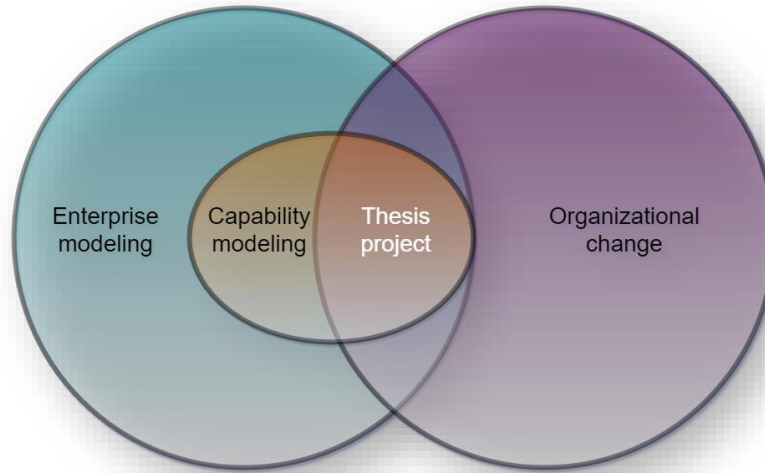


Fig. 2. Positioning the thesis project amidst its relevant fields and concepts.

4.2 Define requirements

The second activity suggested in [35] concerns the transformation of the problem that was previously explicated into a set of elicited requirements. The requirements need to be defined in a way that properly addresses (i) the functionality, (ii) the structure and (iii) the environment attributes of an artifact that can tackle the explicated problem.

This thesis project will need elicitation of requirements based on organizational states that managers are usually unaware of, a fact that requires a deep level of understanding of the organization. Empirical research using interviews is convenient for this level of understanding, since findings derived from analyzed interview data may provide valuable insight to the researcher.

4.3 Develop artifact

It was suggested in [35] that the process of the actual development of the artifact follows requirements elicitation. The artifact designed during this activity should address properly not only the previously explicated problem, but also the previously elicited requirements in terms of both functionality and structure.

The first step of the artifact development process is the introduction of a new capability typology, which is discussed below. Succeeding steps include the development

of a method and provision of tool support for the method. The result of the initial method engineering process will be a small prototype that will be conceptually validated and, going iteratively through steps three and four, the prototype will evolve into its final version in order to proceed to evaluation.

Introducing more capability classes.

Derived from the goal classification discussed in an earlier section, the capability classification introduced in this project is dividing capabilities based on enabling the potential to achieve a goal or avoid a problem. This is still on the widely researched positive side of the capability approach. Achieving goals produces value and avoiding problems facilitates sustaining the organization’s advantages. As a result, a positive capability produces value for an organization and a sustainability capability supports it. Yet, in practice, an organization does not always possess the capability to achieve a goal or avoid a problem. These are states that need to be properly represented in an enterprise model, and, in particular, a capability model that aims to depict properly the reality of an organization and its environment.

An organization, whose potential to achieve a goal is disabled, can be considered as possessing an organizational incapability. In a similar way, an organization whose potential to avoid a problem is disabled can be considered as possessing a negative capability. These are both disadvantages for an organization. A model that properly depicts these disadvantages, along with the factors that have significant association with their existence, can prove to be valuable information for the strategic decisions involved in organizational transformation. Table 2 below provides a summary of the capability classification introduced in this thesis project.

Table 2. Introducing a new capability typology

| | Achieve goals | Avoid problems | |
|--------|---------------------|---------------------------|---------------|
| Can | Positive Capability | Sustainability Capability | Advantages |
| Cannot | Incapability | Negative Capability | Disadvantages |

The capability typology introduced above aims to guide the transformation of an enterprise by guiding the transition process between different capability types, for example, incapacibilities to positive capabilities and negative capabilities to sustainability capabilities. This can be achieved by restructuring resource sets in an organization.

In addition, an organizational capability cannot always be planned, predicted or intended. Sometimes changes in a turbulent organizational environment provoke new goals or problems to emerge that, as a result, provoke new capabilities to emerge or existing capabilities to become detectable. In this case, it is safe to consider this type of capabilities as unintentional and spontaneous, as opposed to intentional capabilities that are brought into existence through strategic planning.

Considering the detection of all these capability types, it is equally important for the developed method to facilitate the detection of all these capability types. Value generating and supporting capabilities may be easier to detect than negative capabilities or incapacities. Organizations are probably unaware of the existence of the latter. This fact may be the result of poor initial design or changes in the internal or external organizational environment resulting in positive capabilities becoming outdated and yielding negative results. In simple words, something that is not working as intended anymore. In any case, capability transition can be performed as a planned task or as a response to unexpected stimuli, therefore the abovementioned typology can facilitate both types of change.

While time seems to be a factor affecting organizational capabilities and their effects, there are more factors affecting every type of capability introduced above that remain unexplored. These factors include all the conditions that affect not only the appearance, sustained existence or extinction of capabilities, but also the conditions that affect the transition among organizational states. This thesis project aims to identify and depict these factors using a modeling notation that properly represents organizational potential both for good or bad. In other words, the modeling notation that will be suggested through this research will depict both advantageous and disadvantageous organizational attributes as a means to provoke or facilitate organizational transformation.

4.4 Demonstrate artifact

This activity concerns using the artifact in the solution of a problem instance, i.e. an illustrative or real-life case, in order to prove its feasibility as a problem-solving creation [35]. For the provision of proof of the method's feasibility as a solution to the addressed problem, the researcher will select an instance of the problem. The criteria for selecting the case concern the artifact's components used in the case. The purpose of the demonstration is to include the functionality of as many components as possible. This is associated to the guidelines provided in [35]. For this step, they suggest to:

- Justify the chosen case by explaining why it is representative of the problem and challenging enough to provide adequate testing of the artifact.
- Clarify how much of the artifact is being tested, in other words, which of the artifact's components are actually being tested during the demonstration.

In addition, a comparison between the problem and the requirements will be performed because [37] suggest that during demonstration, there should be a clear comparison of the specific problem that has been selected as a use case and the requirements that were elicited and defined in an earlier step of the design science research. Finally, this step includes performing three additional procedures suggested by [34]. The authors suggest that (i) an accurate and explicit definition of the artifact's environment objectives, (ii) a definition of how the artifact should be tested and (iii) a description of the mechanisms that will generate results to be monitored, is a set of procedures that plays the role of a validation method for design science research as it ensures that the generated results derive from the environment it was developed for.

Over time, an appropriate use case will be selected in order to demonstrate the effectiveness and applicability not only of the method, but also of the supporting tool that will be developed in ADOxx [38]. The process will be iterative and incremental, since the initial prototype's conceptual validation will provide valuable insight and facilitate eliciting more requirements in order to expand the prototype until it is ready to be demonstrated and empirically validated using a real life use case.

4.5 Evaluate artifact

During the activity of evaluation, the problem-solving capabilities of the artifact are determined based on its performance during the demonstration and the degree to which the elicited requirements are fulfilled. In this thesis project, both the method and its supporting tool will be evaluated by performing an empirical research addressing how effectively the method and tool have addressed the specific given problem.

Empirical research will be performed in order to evaluate the efficiency of the developed method and supporting tool.

5 Research progress

A literature review, which is still in progress, aiming to identify to what degree capability-driven EM has been used to depict organizational dynamism, consists of two steps.

The first part of the literature review consists of a structured keyword analysis around the concept of dynamic capabilities which is used as a means to map the research field and identify strong and weak associations between the dynamic elements of capabilities and relevant concepts and their associated research fields. The analysis is still ongoing, however, several findings already exist, for example a weak association between dynamic capabilities and EM. The complete results will be published in a research paper.

During the planned second part of the literature review process, the identified weak associations will be used as a means to delimit the review area and perform a systematic literature review on the major weak associations. In particular, the abovementioned weak association will be used as an indication of a possible research gap hypothesis, which will be confirmed or rejected through the systematic literature review.

6 Conclusion

The main contribution of this thesis project lies in the identification of a research gap and its tackling through the introduction of an alternative viewpoint on organizational change that includes not only the advantages, but also the disadvantages possessed by an organization.

Identifying the factors involved in organizational change and utilizing them to facilitate the process of transition from disadvantages to advantages is a side contribution of this thesis project.

Several aspects of organizational transformation may be benefited from the capability-driven method suggested in this paper, for example digitalization. A plethora of organization types may reap benefits by adopting a structured method to facilitate transition. Commercial, educational or health care organizations both in the private and public sector are only a few examples of organization types that are constantly facing change and will possibly help identifying a use case for demonstrating and evaluating the artifact developed in this thesis project.

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