A Process Approach for Capability Identification and Management

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Abstract: Enterprises reach their goals by implementing strategies. Successful strategy implementation is affected by challenges that an enterprise has to face and overcome. Enterprises require specific capabilities in order to be able to implement strategies in an effective way and achieve desired results. The demand for a systematic capability management approach is thus growing. This paper introduces a general process for identifying, improving, and maintaining capabilities in an enterprise. This process is based on an integrated capability approach that results from a number of investigations performed over the past years. Comprised of four building blocks, the capability management process represents a flexible engineering approach for capability catalog developers and designers.

1 INTRODUCTION

Organizations have to be more sensitive towards the implementation of business strategies and their consequences on, e.g., processes, customers, and / or application systems. In fact, while enterprise structures are becoming increasingly complex, changes inside such structures have frequently presented enterprises with challenges over the last decade. Economic success depends on sound strategies that support the realization of defined goals. Therefore, it is not only important to be aware of existing challenges and problems but also to continuously gather and assess information about organizational knowledge, responsibilities, available resources, and processes required for strategy implementation (Wißotzki et al., 2013).

Enterprises are equipped with various capabilities tailored to their situation and setting, but many are not aware of them. For this purpose, an integrated capability approach is needed that supports the identification and description of capabilities required for an effective operationalization of enterprise strategies. These capabilities should then be derived systematically through a structured process, gathered and managed in an enterprise-specific repository that we call "capability catalog."

This paper provides a description of a generic capability management process, including a preparation phase, a capability identification and refinement phase to define and manage them in a capability catalog, and an analyzing and maintenance phase for update purposes by following the design-science research paradigm.

1.1 Starting from Strategy

In general, strategies could be understood as impulses for actions to be taken to reach a certain goal. In the context of an enterprise strategies supports an organization to achieve defined goals with the aid of long-term planned behavioral patterns. However, modern approaches of strategy formation usually concentrate on the market positioning of products and services and enabling operationalization thereof inside a business model (Simon et al., 2014).

However, there are two fundamental challenges when it comes to the realization of strategies to achieve defined goals: (1) The creation of an action catalog for strategy realization, as well as performance and liquidity planning, takes place in the process of strategy formulation. Nonetheless, an action catalog requires an enterprise to have a structured view of its capabilities in order to be effective. (2) Even though a strategy is designed for long-term efforts, there is the requirement to remain responsive to any changes in the business environment.

This flexibility is essential in order to react to

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new drivers and constraints such as changed customer needs, new technologies, or statutory regulations (Wißotzki et al., 2013). Although this requirement does not appear to be new, an immediate ability to evaluate changes and corresponding consequences is necessary, which could be supported by a capability management process (CMP).

1.2 Research Approach

The *design-science research* (DSR) approach was applied for research investigation. DSR is a construction-oriented problem solving paradigm in which a designer creates innovative artifacts, in our case the CMP (artifact type: method (March and Smith 1995), answering questions relevant to human problems, thereby contributing new knowledge to the body of scientific evidence (Hevner and Chatterjee, 2010). As a problem-solving paradigm, design-science research resembles utility and its artifacts have to be evaluated. Therefore, our approach consists of two main stages.

The *first stage* is the problem investigation rooted in empirical and conceptual research, e.g., conducting systematic literature analysis, surveys, and expert interviews. We used a project-driven method- engineering approach that is based on our experiences in three different research projects: (1) EACN Project (www.wirtschaftsinformatik-rostock.de), (2) CaaS Project (http://caas-project.eu), and (3) The Open Group Capability Improvement Project (http://www.opengroup.org).

The *second stage* focused on preliminary findings combined with the results of a first executed action research cycle (Wißotzki et al., 2014); hence, the proposed method called Capability Management Process (CMP) is a part of a larger body of a work in progress. The purpose is to develop an appropriate management process for the preparation, identification, organization, evaluation, and maintenance of capabilities in enterprise environments. It should provide clear guidance and accommodate established state of the art and best practices to overcome challenges described in this chapter.

2 THE INTEGRATED CAPABILITY APPROACH

As part of the CMP development, we propose an integrated capability approach that supports the identification of capabilities required for an effective operationalization of a strategy. Using this approach, capabilities should then be easier derived systematically through a structured process and gathered in an enterprise-specific catalog.

This approach was motivated by a requirements catalog based on the demands of mentioned research projects (cf. section 1.2) working within the capability context. In order to identify an elementary capability approach that considers the requirements and delivers concrete descriptions of capability elements we used different surveys, expert interviews and systematic literature analysis whose findings are summarized in (Wißotzki et al., 2013) which involves the following capability definition: *A capability represents the ability of an enterprise to join resources and information in order to support a strategic goal. This combination is applied in consideration of the specific context (used for capability type definition) and executed in a defined and repeatable activity or process for which certain roles resp. actors take responsibility in order to produce a desired outcome.*

The definition forms the basis for the architectural integrated capability approach as assimilated part of the Business Execution Layer (Simon et al., 2014).

At the current state we could distinguish three capability types:

1. Business Capabilities (business context)
2. EAM Capabilities (architectural context)
3. IT Capabilities (IT context)

Basically, these types have different kinds of context objects, which in turn depends on the area of application (Bazire and Brézillon, 2005). For instance, the context of business capabilities represents a combination of objects of the business architecture (e.g., product, market, or customer) and management activities, whereas the EAM capabilities context is defined as a combination of architectural objects (e.g., application, information flow, or component) and management functions (Wißotzki et al., 2013).

However, referring back to the definition of a capability it requires an additional set of elements to be considered: the required information, roles/ actors with competences to help create a specific outcome, the relevant activities or processes, and appropriate resources.

3 THE CAPABILITY MANAGEMENT PROCESS

We now return to the following question: *What kinds of capabilities are required for an organization within a certain area of application in order to achieve defined goals?*

We deal with this question using the concept of a capability catalog that describes a collection of capabilities necessary to support the implementation of an organization's strategy. The subsequent process is applied to support the identification and creation of a capability catalog. This section offers a description of our Capability Management Process. The CMP consists of four building blocks (BBs), each focusing on distinct contents and having distinct outputs.

In short, the first building block sets *preparation* conditions like problem, scope, and stakeholder definition. The second building block *designs the capability catalog* structure, whereas the third block develops the *detailed capability content*. The *analysis and maintenance* building block covers catalog evaluation and maintenance issues (see Figure 2). The following sections provide more detailed explanations of each phase and sub-steps involved in these phases.

3.1 Preparation (BB1)

The first building block defines conditions for the capability catalog to be created and forms the outer frame of the catalog. Therefore, the first building block (BB1) will be divided into the four steps: (1) *Scope & Application Area; (2) Terms & Concept Identification; (3) Capability Context Definition; (4) Development Strategy Definition*.

In the first step, called *"(1) scope & application area,"* stakeholders and the focus of the required capability model are clarified. The involved parties have to agree on the application area and the goals of the capability catalog that is to be created. Accordingly, several questions are relevant here, e.g.: What kind of support do stakeholders expect from a capability catalog? Does the catalog cover domain- or context-specific questions or is it used for more general purposes? Who is involved in the development of the catalog (e.g., managers, domain experts, etc.)?

The understanding of the capability concept may vary among the relevant stakeholders. Therefore, the step *"(2) terms & concepts identification"* will identify terms and common perspectives to define a consistent capability concept. Starting with a general example of the capability approach is intended to create a common understanding of the perspective at hand. Nevertheless, obtaining an overview of already existing definitions and concepts in the area of capabilities during preliminary stages is advisable in order to either use or extend present standards. Questions like: Are there existing capability approaches, projects, catalogs, or maps in the enterprise? How is the concept of capabilities applied? should be answered here. Results of this particular stage have to be documented and made available for the involved stakeholders. At this point, the global requirements of the capability catalog development are defined, and the existing concepts are compared and enhanced by missing components.

In the next step, the "(3) *capability context definition"* activity is carried out. According to (Abowd et al., 1999), a context describes any information that can be used to characterize the situation of an entity. As already depicted, the integrated capability approach section is premised not on an entity but on object-based concepts of the enterprise architecture, i.e., descriptive elements such as roles, information, or resources. Therefore, the context of capabilities is broken down into architectural levels. Referring to (Buckl et al., 2010), capabilities have either a direct or indirect relationship to (other) architectural objects. The introduced descriptive elements are assigned to a capability within this step in order to determine the actual type (see Figure 1). Despite the analyses of scope and application area, attention should be paid to the fact that, for instance, the context objects for business capabilities could depend on industry-specific aspects, since business capabilities are able to enhance both competitive advantages and core competences due to their uniqueness, inimitability, and contribution to the generation of better customer value (Gartner, 2013). In this context, certain objects or functions such as business objects or management functions are defined as context objects, since an interaction of these creates customer value.

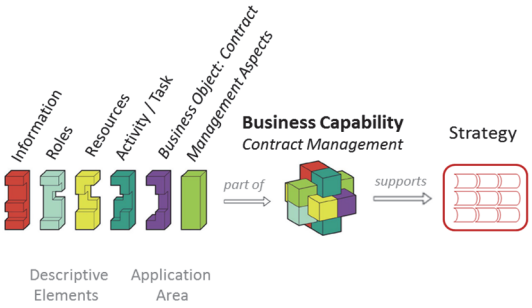

Figure 1: Example for a Business Capability Definition (Jigsaw Cube Image by Corso Ltd.).

Hence, this leads us to the *"(4) development strategy definition"* stage. Here, two different approaches can be distinguished: a new catalog is developed or an already existing catalog is extended.

During the development of strategies, obtaining management approval and support is necessary. In addition, all relevant organizational units and employees have to get access to required information and documents. In fact, informing relevant stakeholders about, e.g., the upcoming activities and the corresponding timeframe is essential in order to obtain the required support. The relevance of the overall project to the enterprise, the purpose of the capability catalog, a time schedule, planned activities, the involved parties, a common understanding of how capabilities will be applied. The main objective here is to create openness among the involved parties or, say, stakeholders to upcoming analyses in order to have a positive influence on both quality and correctness of the identified capabilities. The need for personnel and monetary resources required in the context of a capability development project may have to be justified during the step of BB1.

The quality of a developed capability catalog depends on precise scoping and whether compliance with guidelines for quality management is achieved. These guidelines represent another important component of this phase, as they contribute to quality improvement of the development process and allow an evaluation of the achievement of objectives.

3.2 Catalog Design (BB2)

Subsequent to the determination of content within the preparation stage, the design of the capability catalog is initiated. Hence, capability candidates are identified, collected, structured, and their dependencies are defined: (1) *Capability Candidate Identification; (2) Structuring and Combining*; (3) *Relationships Identification.*

The phase starts off with the *"(1) capability candidate identification.*" The focus of this activity is the definition of the first capabilities. Prior to any analyses, it is important to accurately define the area of application and coordinate the required work (see BB1). The area of application determines the content and concepts being significant for the identification process.

Therefore, the output of BB1 provides the basis for the planning of required identification activities, involved experts, and the effort estimation. For the actual identification process, there are several possibilities that have been successfully used in other fields such as enterprise modeling. Here we summarized different methods we used for analysis with respect to their field of application within the capability candidate identification stage.

CapStorming: The utilization of creativity techniques such as brainstorming in the course of the initialization process of a capability catalog is helpful for the purpose of quickly seizing ideas and combining these with existing concepts. *Survey*: Represents the main technique for gathering information in the context of descriptive capability elements. *Document Analysis*: Is used for either preparation purposes or as an initial step within the identification process (e.g., existing strategy maps, process models, domain architectures). *Written Cases*: Are used in addition to surveys to identify the time and material input necessary to carry out a certain task. *Moderated/ Participative/ Design Thinking Workshop*: Characterizes identification activities and/ or solution development steps that are applied in order to achieve consent among the involved parties.

The initial activities for identifying capabilities should be kept as short as possible. In general, these initial activities result in a roughly structured collection of individual capabilities or at least capability ideas. The origin of the identification process is a so-called "*capability identification matrix*." At the X-axis and Y-axis of the matrix, you find the context objects. For a business capability "market analysis", e.g the X-axis contains a context object called "market" (business object). At the Y-axis, there are simplified management processes like "planning", "execution", and "controlling". Consequently, the matrix cell at the intersection of the "market" object and an analysis step of the "planning" phase would then represent the "market analysis" capability.

After collecting initial capability suggestions, the results need to be analyzed (with regard to their context), discussed, and, if necessary, restructured. Within the step *"(2) structuring and combining*," redundant elements are removed and capabilities that have a strong coherence as to content are aggregated or further specified. Within this stage, content-related aspects are combined to create a catalog that is both easy and clear to understand. In case there is a large amount of capabilities, which could be aggregated or categorized. Accordingly, similar capabilities are either pooled or integrated using appropriate decomposition levels. It is necessary to have this agreed by the involved stakeholders and document questions and critical

comments that may occur. Subsequent to the first refinements of the capability catalog, participants work on additional iterations with the aid of the collected questions and critical comments in order to suggest further changes and enhancements. The objective of this step is to classify identified capabilities, create a consistent structure, and fix capability names and prepare stable descriptions.

Since the collected improvement suggestions usually may not guarantee a sufficient, complete, or consistent capability catalog, it is necessary to conduct further analyses and reorganizations. In addition to an improved level of detail that is achieved in BB3, dependencies among capabilities need to be identified and documented. During the step *"(3) relationships identification,"* different relationships are documented and analyzed. As a result of identifying missing relationships, removing inconsistencies, and discovering gaps, there is an enhancement of both the knowledge represented by the catalog and the understanding of capabilities being available within an enterprise. Implicit, undesired, or overlapping relationships between capabilities have to be detected and adjusted. The different relationships between capabilities can be classified as follows: *Informative Relationship:* Which capability depends on information provided by another? *Supportive Relationship:* Which capability is a prerequisite for another? *Functional Relationship:* Which capabilities represent different aspects in the same matrix column? For more advanced results analysis methods like the "Business Capability Dependency Analysis Method" (Freitag et al. 2011) could be executed.

3.3 Develop Details (BB3)

Creating a capability catalog is typically an iterative process that is completed once every capability is described in a sufficient level of detail for supporting the strategy implementation of an enterprise. Thus, the third building block is responsible for the refinement of already achieved results by applying the following steps: (1) *Catalog Content Layer Definition; (2) Capability Content Engineering;* (3) *Develop & Test Views.*

The initial step of the third building block (BB3), *"(1) catalog content layer definition,"* addresses the definition of the content and associated depth in order to provide both a final structure and order of the capability catalog. This step is important in case the catalog needs to achieve a high level of detail in the terms of content (e.g., by specifying descriptive elements and defining evaluation criteria). We used a three-level approach for the content layer definition. The capability identification matrix represents the first level and is used to identify contextual capabilities. At the second level, i.e. the capability content, descriptive elements are specified. Finally, different kinds of evaluation criteria are developed at the third level.

After specifying the number of content layers covered by the catalog, a systematic analysis of the identified capabilities as part of the *"(2) capability content engineering*" step is advisable. Here, the capabilities are actually described in further detail.

According to (Ulrich and Rosen, 2011), the following list presents a number of basic principles for the capability content engineering process: (i) Capabilities define what is done, not how to do something; (ii) Capabilities are nouns; (iii) Capabilities are defined in terms of their application area (i.e., there should be no technical terms for describing business capabilities); (iv) A capability should be enduring and stable, not volatile; (v) Capabilities are not redundant; (vi) There is one capability map for an application area; (vii) Capabilities can have relationships to other capability types.

During the engineering process, the entire capability catalog appearance may still be subject to substantial changes. The catalog's structures are depicted with the help of models that support a clear and consistent conception of the catalog. Prior to any adjustment, a review of previous work is required. Afterwards, an elaboration or refinement of the descriptive elements can be carried out. An elaboration of the "market situation analysis" capability, for example, would be performed with respect to the following questions: What information is required in order to conduct a market situation analysis? Which roles are able to provide information and make decisions with respect to this object? What resources are required to perform a market situation analysis? How is a market situation analysis performed and what kind of output is produced? Are there already predefined activities or a standard process for market analysis? Are there any references of already defined capabilities to logical objects of the enterprise?

The third building block is completed by the *"(3) develop & test views*" step. When describing capabilities in detail, it is necessary to ensure that every capability is formulated in a general manner, i.e. there should not be any connection to objects such as particular applications or markets. However, capabilities may be well linked to logical elements. For instance, the connection between strategy, goal,

and corresponding capabilities for its realization could be captured in a view. In general, views might be applied to present specific sets of capabilities to different kinds of stakeholder groups. In particular, one of the following sample views might be created: required maturity level vs. current maturity level of a capability used for strategy implementation, costs of creating a capability, dependencies between capabilities, financial aspects (revenue, profit), or a business capability overview. For presentation purposes, different tools and technical measures (multiple video projectors or monitor screens, special software tools) may be used. This is to name just a few examples: data and tree maps, radar charts, parallel coordinates, cone trees, or layer charts (Lengler and Eppler, 2007).

3.4 Analysis & Maintenance (BB4)

The last building block describes an important, remaining stage in the context of analyzing and introducing a capability catalog. In fact, this BB4 addresses the quality- and communication management issues of a created catalog. The paragraphs below describe these activities in detail: (1) *Evaluation Concept;* (2) *Catalog Evaluation & Analysis;* (3) *Catalog Deployment & Communication;* (4) *Catalog Maintenance.*

Even though there are a lot of approaches dealing with quality criteria and evaluation methods in the context of, for example, business processes, there is still little progress in the application area of evaluating capabilities. Approaches most often build on ordinary methods for quality control or are impractical for the designated purpose. This might have originated from an omitted preparation phase, which is normally used to describe the quality criteria a catalog has to satisfy.

The subject of the "(1) e*valuation concept*" step can be the development process (the way the catalog is constructed), the designed result (the catalog itself), or both, which is necessary to produce rigor and practical relevant artifacts. Due to practice-oriented reasons, this section exclusively covers the evaluation of capability catalogs itself. Accordingly, the quality level and quality criteria have to be elaborated during this stage to make measuring possible. Appropriate criteria can normally be derived from the goals predefined in the scoping of the capability catalog. In addition to conducting an overall review of general quality standards such as completeness, accuracy, flexibility, linkage, simplicity, intelligibility, and usability, it is recommended to apply comprehensive evaluation tools, e.g., capability maturity models, in case of large capability catalogs. Maturity models may be applied in the "(2) *catalog evaluation*" step. After such an evaluation, the second building block can be revisited and the feedback can be used as an input for further iterations of catalog development.

The way of integrating a catalog into an enterprise has a vital influence on the success of this catalog. To this end, the *"(3) catalog deployment & communication*" step addresses the implementation resp. roll-out of a catalog in the organization. The success of integrating a capability catalog depends on two major elements: (i) The capability catalog has a high-quality level; (ii) Stakeholders (e.g. board level, business developers, line managers) are satisfied with both the approaches and achieved results. The completed capability catalog thus needs to be formally presented to the steering committee and contracting authority, respectively. This should be delivered either in the form of an intermediate presentation or as part of the project completion. It thus needs to be ensured that the requirements of the stakeholders are satisfied. To achieve this, accurate planning and preparation is required. The project team needs to be able to enhance the results of the capability catalog creation process, i.e. converting the final catalog version, descriptions, and illustrations into an appropriate form of presentation.

Besides, changes in the domain knowledge and management approaches can create the need for improvements in the catalog (Lahrmann and Marx, 2010). For these reasons, the maintenance step will be passed through, which is necessarily an iterative process. Ensuring the catalog relevance over the years, this step addresses the evolution of the model. As an enterprise may have to meet new challenges and capabilities need to be modified accordingly, there is an ongoing *"(4) catalog maintenance*" process in addition to evaluation methods applied to create a high-quality capability catalog. Accordingly, these are the following advantages of the introduced process step: (i) Structure and comprehensibility, (ii) Precise descriptions, (iii) Simplified modifications and reorganizations of the created catalog, (iv) Contributes to the organizational learning and securing of organizational knowledge.

Consequently, an improvement of both, quality and usage period of the catalog is addressed within the last step of this building block. Modifications in the catalog structure as well as slight changes may occur in this step. from lahrmann and marx 2010, we adopted three of four extension patterns for the purpose of catalog maintenance. a general update of

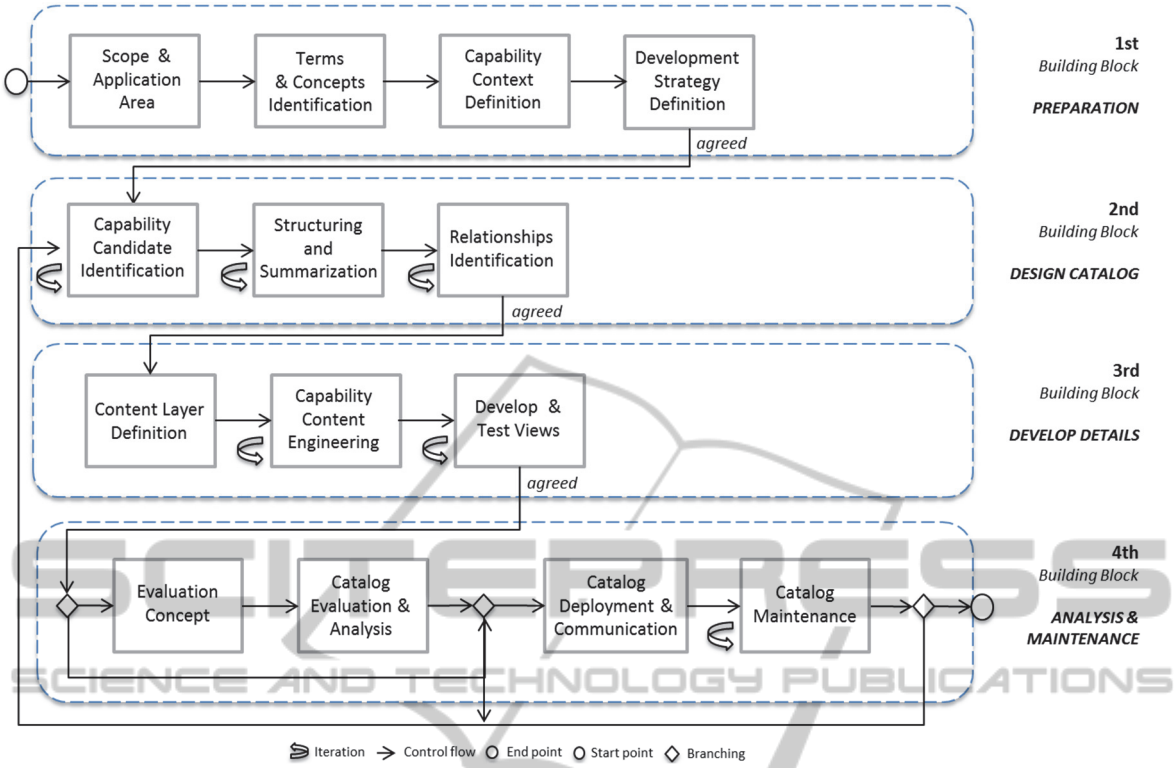

Figure 2: The Capability Management Process.

capability catalog elements such as by adding new descriptive elements or updating the evaluation mechanism (e.g., maturity assessment procedure) may be examples of the first pattern. it is also possible to add new context objects or reorder their configurations, e.g., by changing attributes that might influence the identification process (section 3.2) or at least reconfigure the relationships between different capabilities. although these extension patterns challenge the metastructure of the capability catalog to some extent, they would not require passing the first building block and beginning the development process again by redefining the scope, as this would go beyond the scope of maintenance.

4 VALIDATION

In line with Duhan et al., 2005, the catalog verification determines if the artifact represents the developer´s concept accurately and it tests the model against a set of theoretic evaluation methods.

Therefore, we proofed to what extend the presented CMP meets requirements of a method in context of a method engineering approach. In general a method represents a prescriptive structure that explains what to do in different situations and how certain goals can be achieved (represented by phases of the CMP). In this regard (Goldkuhl et al., 1997) proposed an approach for establishing a series of significant elements a method should consists of. The first element we proofed is called method component that consists of procedures, concepts and notations cooperate (provided by building blocks and its description of the individual phases). The structure formed by the different method components is called framework that covers the order of execution (*BB1* → *BB2* → *BB3* → *BB4*). The perspective describes another method element that provides issues like philosophy, principles or objectives of the method and provides the conceptual view on it (provided in section 1.1 and section 2). Requirements form the method element collaboration like roles and collaboration techniques (brainstorming, mind mapping, stakeholder analysis, communication plan) are considered during the creation of the CMP method (provided in BB2). Nevertheless, some weaknesses were observed with regard to a predefined notation for BB results, just some suggestions are provided (see BB3) and no cohesive notation concept. Furthermore, a more precise and aligned concept for the collaboration forms should enhance quality of the method. These are already aspects we will consider in the next iteration. In

terms of a scientific validation and under consideration of the DSR paradigm and its recommended methods we used action research cycles (ACR) and published the concept and first validation results on ICEIS 2014 (Wißotzki et al., 2014). More action research cycles are still in progress with companies from the plane and train manufacturing branch and utility industry that will cover notation, collaboration and utility issues.

5 CONCLUSION / OUTLOOK

Enterprises reach their goals by implementing strategies. Successful strategy implementation is affected by challenges that an enterprise has to overcome. Enterprises require specific capabilities in order to be able to implement strategies efficiently and achieve a specific outcome. A demand for a systematic management approach to identify capabilities is growing.

We presented a generic approach that can be used to derive capabilities through a structured process and gather them in an enterprise-specific catalog for an effective operationalization of enterprise strategies. A capability here describes a certain combination of information, roles, activities/ procedures, and resources to support issues like strategy implementation, planning purposes, or transformation processes.

Following a four-building-block approach, we described a straightforward and flexible process for capability catalog developers and designers, which allows the integration of descriptive elements for different capability types. The CMP is based on the approach of (Wißotzki et al., 2013) and it forms a tool that facilitates the development of scientifically well-founded capability catalogs aligned with the design science research guidelines (Hevner and Chatterjee, 2010). In particular, our approach provides a building block covering the continuous evaluation and maintenance in order to sustain capability and catalog quality.

Additional detailed content of the building blocks and corresponding steps will be provided by more ACR executions and have only been mentioned to some extent in this section 4. Our future research will elaborate on this topic and demonstrate more practical use cases of capability catalog development projects. In fact, our aim is to focus more on use cases and / or possible applications in order to indicate the tradeoffs of our approach and to evaluate and potentially extend the process.

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