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Enterprise Architecture Management: Toward a Taxonomy of Applications

Abstract:

Despite the growing interest in enterprise architecture management, researchers and practitioners lack a shared understanding of its applications in organizations. Building on findings from a literature review and eight case studies, we develop a taxonomy that categorizes applications of enterprise architecture management based on three classes of enterprise architecture scope. Organizations may adopt enterprise architecture management to support IT strategy formation, planning and implementation; facilitate business strategy planning and implementation; or further complement the business strategy formation process. The findings challenge the traditional IT-centric view of enterprise architecture management application and suggest enterprise architecture management as an approach that could support consistent design and evolution of an organization as a whole.

Keywords: Enterprise architecture, Enterprise architecture management, Application, Taxonomy, Case study

1 Introduction

Interest in enterprise architecture (EA) has grown significantly since the Zachman Framework was introduced in the 1980s (Simon et al., 2014). Organizations are increasingly adopting enterprise architecture management (EAM) concepts to coordinate enterprise-wide transformations of their complex business and IT asset landscapes (van der Raadt and van Vliet, 2009). However, researchers and practitioners still lack a common understanding of EA's meaning and scope (Lapalme, 2012). In the literature, the term EA is used to refer to anything from the property of an enterprise and its inherent structure (e.g., Bradley et al. 2012), to description of an enterprise in terms of its composition and structure (e.g., Bernard, 2012), and to processes for its management and evolution (e.g., Lapkin et al., 2008). EA scope also ranges from IT components (Richardson et al., 1990), to business processes and organizational structure (e.g., Lankhorst, 2005), and to business strategy, vision, markets, and products and services (e.g., Simon et al., 2014). The differences in perspectives on EA have also resulted in diverse views of EAM goals and applications, roles and responsibilities of enterprise architects, and the integration of EA functions into organizational governance.

Despite the fact that EA scope may span both business and IT realms, EA is traditionally considered equivalent to IT architecture. Organizations often adopt EAM to support management of IT architecture design and evolution (Heiß, 2015; Simon et al., 2014). Among the practitioner studies with an IT view of EA is Gartner's typology of vanguard and foundational architects (Blosch and Burton, 2014). The IT-centric view of EA and EAM applications is also dominant in EA academic research (e.g., Boh and Yellin, 2006; Richardson et al., 1990). However, some studies indicate a change in perspective on enterprise architects' responsibilities from supporting IT architecture evolution toward facilitating strategic transformations (e.g., Simon et al., 2014; Strano and Rehmani, 2007; Wagter et al., 2012; Wißotzki et al., 2013). This turns EAM into an approach for systematic development of an organization as a whole.

The ambiguity of the term EA and confusion around EAM applications served as motivation for us to conduct a study to clarify the terminology and various applications of EAM in organizations. In this quest we asked and answered two questions: What does EA mean? How do organizations use EAM (i.e., for what objectives)? To answer these questions, we first conduct a structured literature review to compare various perspectives on the term EA and different views of EAM applications among EA researchers. A

synthesis of the literature results in a taxonomy that classifies EAM applications based on three perspectives on EA's scope. We then examine the taxonomy using case studies of eight Danish organizations that actively manage their EA. The case studies provide empirical support for the suggested taxonomy and enable its further refinement. The proposed taxonomy suggests that EAM may complement processes for IT strategy formation, planning and implementation; business strategy planning and implementation; and business strategy formation, depending on whether EA scope covers IT, business capability, or business strategic elements of an organization. The taxonomy sheds light on the wider range of EAM applications, rectifies confusion among researchers and practitioners about EA and EAM applications, and assists managers in conscious decision making about EAM adoption based on their goals and requirements.

The remainder of the paper is organized as follows. In section 2 we describe our research methodology for developing the taxonomy. In section 3 we present the literature review in terms of the diverse perspectives on the meaning and scope of EA, followed by the three archetypes of EAM applications derived from synthesis of the literature. We then describe cases and findings from cross-case analyses in section 4. Drawing on the empirical findings, section 5 revises the suggested taxonomy. Section 6 provides a discussion of contributions and their grounding in the literature. Section 7 concludes with a summary of contributions, limitations, and potential extensions of the research.

2 Research Methodology

We conducted the current study in three stages as depicted in Figure 1. This section presents our research methodology for each stage.

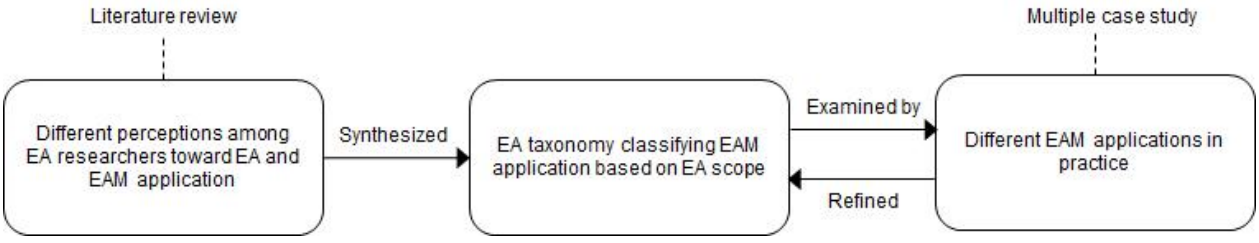

Figure 1. Methodology and Contribution of Paper

First, to understand diverse perspectives on the meaning of EA and application of EAM, we conducted a comprehensive literature review of scientific journals and conference publications available via the Web of

Science and Scopus. As illustrated in Figure 2, after scanning titles and abstracts of papers identified through database searches and citations trailing relevant papers, the first author retrieved more than 240 papers for full text review. She then selected more than 80 papers for analysis based on relevance of the topic and her subjective judgment regarding originality, methodological rigor, and theory robustness. Appendix A provides the list of selected papers. She carefully analyzed and coded each paper, seeking especially concepts such as EA and EAM definitions, EA scope, EAM applications, and EAM governance and functional roles and responsibilities. Appendix B presents the codebook she used for analyzing the selected papers. Developing the codebook, she followed the approach suggested by Guest and MacQueen (2007). Also following Corbin and Strauss's (2008) approach for coding, she supplemented each code with extensive memos describing her understanding and critical assessment of the paper's perspective on the concept and its comparison with other papers. Each memo also reflected on dimensions and properties of the concept. Subsections 3.1 and 3.2 present a comparison of various definitions of EA and assumptions about EA scope as identified through literature analysis.

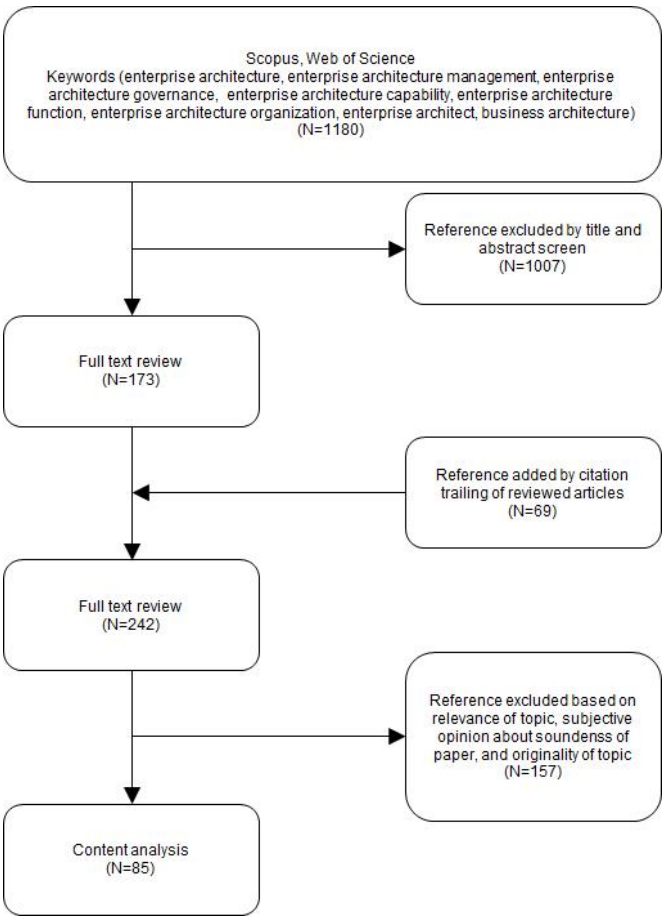

Figure 2. Literature Search for EA-related Topics

Second, upon analyzing EA definitions and comparing different notions of EA scope specified in the literature, we identified three perspectives on EA scope among researchers. Assuming that a given view of EA scope influences EAM goals and applications, we categorized the literature based on their perception of EA scope and created mapping between EA scope and EAM application. We structured the findings as a taxonomy that classifies various applications of EAM based on three classes of EA scope. This taxonomy is presented in subsection 3.3.

Third, to examine and refine the taxonomy and to understand the applications of EAM in practice, we conducted case studies in eight large Danish organizations with discrete EA functions. As practitioners have very different understandings of EA and adopt EAM for varied purposes, we found the topic too complex to be investigated through a survey. We also found the case study to be a more suitable approach due to our focus on organizational aspects of EAM, and our objective of understanding EAM in conjunction with its context (Benbasat et al., 1987; Orlikowski, 1992; Yin, 2009).

Adopting a theoretical sampling methodology (Eisenhardt, 1989), we based our case selection on the three EA archetypes derived from the literature analysis. Seeking a sample of organizations across which various applications of EAM could be compared, we chose the cases based on prior knowledge of their EAM applications. We also followed a snowball approach (Patton, 1990) and asked the interviewees for organizations in which EAM application was different from their home organization. We continued sampling until we could identify organizations fitting each archetype specified in the taxonomy. Therefore the selected cases are polar types chosen to fill theoretical categories (Eisenhardt, 1989). Focusing only on large Danish corporations reduced potential variation in approach toward EAM linked to size (Aier and Schelp, 2010). All selected cases had a centralized IT function; they varied by industrial sector, and overall organizational governance model and extent of centralization in business decision making. As the latter factors could have an impact on the organization's approach in adopting EAM (Haki et al., 2012), we focused special attention on them during data analysis.

We used semi-structured interviews as the primary method of data collection. Because of the small number of interviews and interviewees, we did not expect to attain an in-depth understanding of each case. Instead, we aimed at understanding the EA function's mission, organizational position and makeup, responsibilities and accountabilities, involvement in business and IT strategy development and project execution, and major challenges. While the interview guide generally covered the same topics in each

interview, we adjusted questions to probe specific EAM applications in each organization and to allow for investigating emergent concepts from earlier interviews. Appendix C presents the interview guide covering the topics and key questions directing the interview under each topic. Table 1 presents the case organizations and respective interviewee positions.

From April through June 2015, the first author conducted interviews with EA function practitioners in the eight organizations. A total of 14 interviews were conducted, all of which were recorded and transcribed. (Note: Some of the persons were interviewed more than once or were present during interviews with colleagues.) Follow-up questions occasionally supplemented the interviews to resolve ambiguities and inconsistencies. We were also present at two conferences where three of the case organizations presented their EA functions. This provided the opportunity to conduct some spontaneous informal discussions to enhance our understanding of their EAM activities. However, most of the interview data reported in this paper comes from formal interview transcripts. To exploit the synergistic effects of triangulation and obtain convergent validation from various data sources, we combined interviews with a wide variety of archival sources, including documents on EA function objectives, architects' job descriptions, EAM governance processes, and examples of EA roadmaps and target architecture (Tracy, 2010).

We then carried out data analysis in two stages. During the first stage, we analyzed each case with respect to its EAM approach. The first author manually coded the interview transcripts and supplemental documents. The output of within-case data analysis was a set of codes and memos, each abstracting and analyzing the scope of EA in the case organization, its use of EAM, enterprise architects' responsibilities, and governance approach to EAM, among others. Analyzing the data, she took a middle position between open and theory-determined coding (Dey, 1993). She predefined a set of codes based on the interview guide and also by refining the concepts and properties identified during the literature review. At the same time, she allowed for new insights to arise from the case study data. Appendix D presents the codebook used for analyzing the empirical data.

The confidence in findings could have been improved by having multiple researchers acquiring and coding the case data (Eisenhardt and Graebner, 2007). However, this was not possible due to practical limitations. To achieve triangulation, the study used an alternative strategy suggested by Eisenhardt (1989). According to this strategy, researchers take different roles in the course of data acquisition and

analysis to increase the chances of viewing case evidence in divergent ways (Eisenhardt, 1989). During data analysis of the current study, although the first author was the only coder of the empirical data, the second author reviewed and commented on the codes and memos based on his prior knowledge of the cases until both authors could reach a common and more in-depth understanding of each case. The third author did not review the codes, but critically assessed the developed findings as the devil's advocate (Sutton and Callahan, 1987). As the co-authors retained a distant view to the cases, they could bring different and possibly more objective eye to the evidence. Section 4.1 presents each case based on a selected set of concepts. Appendix E also provides quotations from each case's data in relation to various concepts.

Table 1. Cases and Interviewees

Case	Description	Interviewees	Duration of interview(s) (minutes)
Alpha	Global dairy foods producer	Chief architect, enterprise architect	220
Beta	Pension provider and investor	Chief business architect, business architect	120
Gamma	Global apparel company	Chief architect	120
Delta	Global producer of energy solutions	Former chief architect, chief architect	210
Zeta	Energy company	Chief architect, enterprise architect	210
Theta	Global engineering company	Enterprise architect	120
Kappa	Global industrial equipment producer	Business relations manager, information architect, business architect	210
Sigma	Global financial IT service provider	Two market architects	150

In the second stage of data analysis, following Eisenhardt's (1989) suggestion, we compared the cases in pairs based on concepts that identified or emerged during within-case analysis. We used the findings from pair-wise comparisons to classify the cases into five categories. Two factors, EA scope and influence over environment, guided our classification decision. We related EA scope to the breadth of EA function responsibilities covering the design of IT components, business capability elements, business strategy, or a combination of the three. The second factor was associated with enterprise architects' engagement in and influence over decisions in which they do not have formal responsibility. While we derived the first factor from the proposed taxonomy, the second factor emerged during pair-wise case comparisons. The two factors also guided us for mapping cases based on their EA scope. Aggregating only the converging data within each group, we composed narratives describing EA function characteristics and EAM applications in each group. A summary of these narratives can be found in subsection 4.2. We then used the empirical findings to revise the taxonomy, as presented in section 5.

3 Literature Review

Our literature review indicates a large variety of EA definitions and different perceptions of EAM applications. This section presents a summary of the findings from the literature review and analysis. First, we present distinct perspectives of EA among researchers and also our understanding of EA and EAM. Second, we discuss various perspectives on EA scope caused by different understandings of the term "enterprise." Third, categorizing EA scopes into three classes and mapping EAM studies to one of the categories, we propose a taxonomy that explains EAM applications based on EA scope.

3.1. EA Definitions

Table 2 presents diverse definitions of the term EA identified in the literature. Developing the table, we had the first research question of this study in mind: What does EA mean? We only included those retrieved studies in which the author(s) had provided an explicit and original description of EA. Drawing on an analysis of these studies, we identified four strands defining EA as: inherent enterprise structure (e.g., Bradley et al., 2012), blueprint of an enterprise in its various facets (e.g., Rood, 1994), set of principles prescribing enterprise architecture design (e.g., Hoogervorst, 2004), and methodology or process guiding the design of enterprise architecture (Lapkin et al., 2008). We believe these differences originate in lack of agreement on defining "architecture." Therefore, we first probe the definition of architecture.

The Oxford English Dictionary defines architecture as "the complex or carefully designed structure of something." Similarly, ISO 42010:2011 defines architecture as "the fundamental concepts or properties of a system in its environment embodied in its elements, relationships, and in the principles of its design and evolution." Adopting these definitions, we consider EA the fundamental conception of the enterprise in its environment embodied in its elements, their relationships to each other and to its environment, and the principles guiding its design and evolution. Therefore, EA is not a description or a management methodology, but the inherent structure of an enterprise.

EAM then is a management approach that supports planning, developing, and controlling the enterprise's architecture in a coordinated and purposeful manner by providing a holistic understanding of the EA (Buckl et al., 2010; Labusch and Winter, 2013; Lux et al., 2010; Radeke, 2010) and ensuring adherence to EA principles (Hoogervorst, 2004). EAM captures all those processes, methods, tools, and responsibilities

needed to allow for consistent development of the enterprise (Simon et al., 2014). Distinguishing between architecture and architecture description, we recognize EA documentation as a set of practices within EAM for expressing the abstract concept of an enterprise's architecture. EA documentation—by depicting the current and future state of EA, EA roadmap, and EA principles (van Gils, 2009) — assists decision making for enterprise design and implementation. While EA diagrams in the form of current or future architecture state describe EA, EA principles prescribe how EA should be realized (van Gils, 2009).

Organizations usually institutionalize EAM by establishing an EA function comprised of various architect roles. Enterprise architects are typically responsible for providing advice to senior management for EA decision making by creating and maintaining a multi-perspective view of EA (Buckl et al., 2011; Steghuis and Propor, 2008; van der Raadt and van Vliet, 2008). Enterprise architects are also responsible for validating conformance of any architectural changes to current and target EA, EA roadmap, and EA principles (Buckl et al., 2011; Radeke and Legner, 2012; van der Raadt and van Vliet, 2008). Van der Raadt and van Vliet (2008) suggest that EA function reaches beyond enterprise architects' team and also includes the stakeholders involved in EA decision making and EA conformance. Therefore, senior management accountable for EA development, and program and project managers affected by EA principles are typical stakeholders of EAM (Boh and Yellin, 2006; van der Raadt and van Vliet, 2008).

Table 2. Selected EA Definitions, Architecture Meanings, and Enterprise Scopes Collected from EA Literature

Author(s)	Definition	Architecture meaning	Enterprise scope
Bernard (2012)	EA is the analysis and documentation of an enterprise in its current and future states from an integrated strategy, business, and technology perspective.	Description of an enterprise	Strategy, business, and technology
Bradley et al. (2012)	EA is the organizing logic for an organization's IT infrastructure and business processes.	Inherent structure of an enterprise	Business processes and IT infrastructure
Doucet et al. (2009)	EA is the architecture that describes a functioning organization. In order for the architecture to allow us to build or change the functioning organizations it would have to include all the key descriptions such as the mission statement, organization design, business plan, job descriptions, process models, workflows, system specifications, information models, etc.	Description of an enterprise	Mission statement, organization design, business plan, job descriptions, process models, workflows, system specifications, information models
Gøtze (2013)	EA is the inherent design and management approach essential for organizational coherence leading to alignment, agility, and assurance.	Inherent structure and management approach	Not specified
Gregor et al. (2007)	EA is a descriptive representation of the basic arrangement and connectivity of parts of an enterprise (such as data, information, systems, technologies, designs, business processes)	Description of an enterprise	Data, information, systems, technologies, designs, business processes

Table 2. Selected EA Definitions, Architecture Meanings, and Enterprise Scopes Collected from EA Literature

Hoogervorst (2004)	EA is a coherent and consistent set of principles that guide how the enterprise must be designed.	Principles for guiding enterprise design	Not specified
Korhonen (2013)	EA is a holistic, high-level approach to organizational design description and prescription.	Description of an enterprise Principles for guiding enterprise design	Organization
Labusch and Winter (2013)	EA describes the fundamental structures of an enterprise.	Description of an enterprise	Not specified
Lankhorst (2005)	EA is a coherent whole of principles, methods, and models that are used in the design and realization of the enterprise's organizational structure, business processes, information systems, and infrastructure.	Management approach for guiding enterprise design	Organizational structure, business processes, information systems, and infrastructure
Lankhorst (2009)	EA is very much a holistic approach to the design of organizations. All different domains in enterprise design meet: organization, information, systems, products, processes, and applications.	Management approach for guiding enterprise design	Organization, information, systems, products, processes, and applications.
Lapkin et al. (2008)	EA is the process of translating business vision and strategy into effective enterprise change by creating, communicating, and improving the key principles and models that describe the enterprise's future state and enable its evolution.	Management approach for guiding enterprise design	Not specified
Radeke (2010)	EA is an organization's basic structure, which might be captured in terms of descriptive models.	Inherent structure of an enterprise	Not specified
Richardson et al. (1990)	EA defines and interrelates data, hardware, software, and communications resources, as well as the supporting organization required to maintain the overall physical structure required by the architecture.	Description of an enterprise	Data, hardware, software, and communication resources
Rood (1994)	EA is a conceptual framework that describes how an enterprise is constructed by defining its primary components and the relationships among these components.	Description of an enterprise	External environment, strategy, corporate culture, people, organizational structure, processes, technology, and information
Ross et al. (2006)	EA is the organizing logic for business processes and IT infrastructure reflecting the integration and standardization requirements of the company's operating model.	Inherent structure of an enterprise	Business processes and IT infrastructure
Tamm et al. (2011)	EA is the definition and representation of a high-level view of an enterprise's business processes and IT systems, their interrelationships, and the extent to which these processes and systems are shared by different parts of the enterprise.	Description of an enterprise	Business processes and IT systems
Zachman (1997)	EA is a set of descriptive representations that are relevant for describing an enterprise.	Description of an enterprise	Not specified

3.2. EA Scope

In addition to confusion regarding the meaning of architecture, disagreement exists on defining the term "enterprise" and thereby EA scope. While some researchers understand enterprise as a synonym for

"enterprise IT systems", others perceive the term equivalent to an organization. Comparing the various definitions of EA, as presented in Table 2, we identified three major categories for EA scope. In its simplest form EA scope is limited to technical information components, such as application, data, and technology. This perspective is evident in the definition provided by Richardson (1990), and is also the case in the early EA framework suggested by Zachman (Zachman, 2009a). In other studies, EA scope extends from pure IT components to a multi-perspective concept that also covers business architectural elements. However, we found disagreements among researchers on what business architecture consists of. Some researchers extend EA scope to encompass elements realizing business capabilities, such as business processes, information entities, and organizational structures (e.g., Lankhorst, 2005; Ross et al., 2006). Others extend EA scope even further to incorporate strategic business elements of an organization, such as mission, strategy, and external environment (e.g., Bernard, 2012; Rood, 1994).

In the remainder of the paper, the term "enterprise" refers to an organization or components of an organization whose design is coherently and consistently guided by EAM. Therefore, EA scope covers architectural components whose design could be controlled by enterprise architects. Besides, we use the term "environment" to refer to uncontrollable variables that fall outside the enterprise boundaries and thus EA scope.

3.3. Archetypes for EAM Applications

We consider coherent and consistent design and evolution of EA to be the major goal of EAM (Aier and Schelp, 2010; Hoogervorst, 2004). However, the impact of EAM on the real-world state of an organization may differ depending on the organizational processes that EAM supports (Zachman, 2009b).

EAM has traditionally been deployed to support understanding, planning, developing, and controlling the IT architecture of organizations (Simon et al., 2014; Wißotzki et al., 2013). EAM goal is then often associated with consistent design of IT architecture in alignment with business strategy and operations (e.g., Buck et al., 2010). Indeed, EAM application for managing business architecture has not received much attention in the literature and in practice, despite the fact that EA originally covers elements such as business goals, strategies, plans, products, and partners (Simon et al., 2014). Consequently, business architectural elements essentially have been reduced to context variables rather than being treated as design variables (Simon et al., 2014). However, several studies indicate a change in the applications of

EAM in organizations. Tamm et al. (2011) suggest that EAM is a management discipline that not only enhances business–IT alignment but also organizational alignment. Winter and Schelp (2008) argue that EAM is no longer only an instrument for IT planning, but for corporate planning. EA models are evolving from pure IT architecture models into instruments that by providing an integrated view on organization support business decisions (Wißotzki et al., 2013). Accordingly, the role and responsibilities of enterprise architects are moving away from those of information and IT architects toward guiding the design of business (Wagter et al., 2012). Strano and Rehmani (2007) suggest that enterprise architects should be positioned where they can impact business strategic planning and operations.

We argue that perception of EA scope influences the range of processes that EAM could be incorporated into, and thereby impacts an organization's goal and application of EAM. The previous subsection indicated three views of EA scope among researchers depending on whether aspects of business strategy, business capability, and IT components are within the EA scope. In this section, we use these three classes to develop a taxonomy that classifies various EAM goals and applications. To accomplish that, we map EAM studies to one of the three classes based on perception of EA scope, omitting references to studies that do not provide a clear description of EA scope or do not discuss EAM applications. The next three subsections describe the characteristics of each archetype.

3.3.1. EA Scope: IT Elements

When EA scope is limited to IT elements, EA is the organizing logic for IT infrastructure, data, and applications (Ross, 2003). Boh and Yellin (2006), Richardson et al. (1990), and Ross (2003) are examples of studies with such an IT-centric view toward EA. Boh and Yellin (2006) further extend the scope of IT architecture and suggest that in addition to IT infrastructure, business applications, and data, EA may cover human IT resource such as organizational IT skills, competencies, and knowledge. Similarly, the EA description of Richardson et al. (1990) includes the organization required to maintain the overall physical IT structure in the EA scope.

In this view, the goal of EAM is to ensure coherent and consistent design of IT systems (Hoogervorst and Dietz, 2013). By providing multi-perspective representations of the IT architecture, EAM supports IT asset planning (Rood, 1994). EAM facilitates IT asset portfolio management, consolidation of the IT landscape, and controlling the growth of technical diversity (Boh and Yellin, 2006; Riege and Aier, 2009; Rood, 1994).

In addition, EAM supports implementation of IT-related changes (Rood, 1994). The IT-centric EAM facilitates project-level decisions related to data and application design (Boh and Yellin, 2006; Rood, 1994) and further supports IT project management through architecture compliance assessment (Riege and Aier, 2009).

Although the scope of EA in this archetype is limited to IT resources, Boh and Yellin, (2006), Richardson et al. (1990), and Ross (2003) consider EAM to be a discipline that not only supports managing future technological developments but also facilitates achieving business strategic goals through IT. Therefore, the IT-centric EA function is tasked with guiding decision making related to acquisition, development, and implementation of IT resources in alignment with business direction (Boh and Yellin, 2006). Accordingly, Lapalme (2012) defines the goal of IT-centric EAM as aligning an organization's IT resources to effectively execute business strategy and various operations.

3.3.2. EA Scope: Business Capability and IT Elements

In a more comprehensive perspective toward EA, business processes become a typical component of the enterprise (Lankhorst, 2005; Ross et al., 2006; van der Raadt and van Vliet, 2009; Wißotzki et al., 2013). Lankhorst (2005) and van der Raadt and van Vliet (2009) also include business functions and organizational structure in the EA scope. In other words, the scope of EA in this archetype extends to cover elements realizing business capabilities in addition to IT components. A business capability is an ability of the business to perform a particular kind of work and achieve a specific purpose. Diverse elements play roles in business capability realization, including business processes, information entities, organizational structures, people, and culture (Simon, 2014). Lankhorst (2005), Ross et al. (2006), Tamm et al. (2011), van der Raadt and van Vliet (2009) and Wißotzki et al. (2013) are examples of studies with such more expansive view of EA scope.

In this view, the goal of EAM extends to also ensure coherent and consistent arrangement of business processes, organizational structure, and organizational culture (Hoogervorst and Dietz, 2013). In other words, the EAM goal is to enable organizational alignment (Tamm et al., 2011). Enterprise architects support enacting business strategy and developing the organization's operating platform (Tamm et al., 2011). By providing a holistic view of business capability elements and their relationships, EAM facilitates translating strategic objectives into business capabilities and concrete changes in business processes,

governance structure, and IT systems that enable those capabilities and thus organizational objectives (Lankhorst, 2005; Simon et al., 2014; Tamm et al., 2011). EAM as well supports planning business change projects by clarifying their architectural interdependencies and their contribution to strategic objectives (Simon et al., 2014). Furthermore, enterprise architects guide developing the solution architecture of change projects, which provide detailed specifications necessary for operationalizing the business processes and IT systems (Tamm et al., 2011). EAM also supports conformity checks and ensures compliance of changed business capabilities and their core elements (Simon et al., 2014).

Having business capability elements as the design unit enables EAM to guide integrated design of business capabilities and IT systems (Gregor et al., 2007). This facilitates better management of changes to business and IT, and the right balance between business innovation and IT efficiency (Wißotzki et al., 2013).

3.3.3. EA Scope: Business Strategy, Business Capability, and IT Elements

In its most comprehensive form, EA scope extends to encompass an organization's strategic business elements such as business motivation and business model. Business motivation includes elements such as values, mission, visions, goals, objectives, strategy, drivers, and constraints (Hoogervorst, 2004; Simon et al., 2014). Business model may comprise elements such as value proposition, products, suppliers, customers, resources, and value chain configuration (Hoogervorst, 2004; Simon et al., 2014). Rood (1994), Simon et al. (2014), and Winter and Schelp (2008) are examples of studies that describe such a perception of EA scope.

With such an extended scope, EAM supports strategic development of an organization (Riege and Aier, 2009). In this view, EAM ensures coherent and consistent business model design in terms of products and services, delivery channels, customers, economic model, and relationship with the organization's environment (Hoogervorst and Dietz, 2013). Enterprise architects are formally involved in business strategy formation, where goals and objectives are identified, policies are formulated, and strategies are selected to achieve the overall mission of the organization (Simon et al., 2014). By providing a complete and integrated view of drivers, constraints, and current business capabilities, enterprise architects facilitate strategic analyses of internal and external business contexts and development of strategic options (Simon et al., 2014). Therefore, Strano and Rehmani (2007) recommend an interface between

enterprise architects and external stakeholders to ensure external interests are adequately represented in the EA. In addition, EAM enables assessment of strategic options with model-based impact analysis (Simon et al., 2014). By providing a holistic and integrated view of business strategy and implemented business and IT capabilities, EAM also supports strategy reviews following the completion of strategy implementation projects (Simon et al., 2014).

Having business strategy, business capability, and IT components as design variables, EAM ensures integrated design of the organization as a whole in support of transformative changes (Hoogervorst and Dietz, 2013).

4 Empirical Study

Findings from the literature analysis indicated three perspectives on EA scope among researchers, each associated with different goals and applications of EAM. To examine these findings and further characterize each EA archetype, we conducted a multiple case study of Danish organizations seeking various objectives upon adopting EAM. This section presents a brief description of each case, findings from the cross-case analysis, and a mapping of the studied cases to the proposed taxonomy.

4.1. Case Descriptions

Table 3 presents descriptions of the eight cases. As space limitations do not permit comprehensive descriptions, we present the EA function's position in each organization and its role in governing the design of business and IT architecture. The case description is focused exclusively on enterprise architects' prescriptive role in regulating the design and evolution of EA. Using Radeke and Legner's (2012) description of the strategy management process, we categorize EA function involvement in business and IT architecture design into strategy implementation, strategy planning, and strategy formation. Strategy formation consists of assessing the organization's internal strength and weaknesses and external threats and opportunities, elaborating and evaluating various strategic options, and selecting strategic objectives and initiatives. During the strategy planning stage, the chosen strategic options are translated into tactical plans, and projects realizing the objectives are defined, planned, and aligned. These projects are then executed during strategy implementation (Radeke and Legner, 2012).

Table 3. Case Descriptions

Case	EA function position and makeup	EA function role in IT design	EA function role in business design
Alpha	· EA function positioned as staff function to CIO · EA function comprised of chief architect, application architects for various business domains, information architect, and technology architect · No formal business architect	**Strategy formation** · EA function supports defining IT strategy based on business strategy, IT situation, and emerging IT trends · EA function devises strategic initiatives to improve standardization of IT service portfolio · EA function devises strategic initiatives to enhance IT platform based on emerging IT trends	**Strategy formation** · EA function informally consulted for business strategy development to provide IT perspective
		Strategy planning · EA function supports defining IT target architecture and roadmap for various business domains based on business strategic and IT strategic initiatives · EA function supports project ideation, architecture scenario assessments, and scoping · EA function supports project portfolio management by conducting project architecture feasibility checks and providing input for project prioritization	**Strategy planning** · EA function supports planning business initiatives with IT implications · EA function drives business capability standardization to enable IT standardization, but has no mandate for business design
		Strategy implementation · EA function assesses project architecture conformance to EA principles and target architecture prior to, during, and after project execution	**Strategy implementation** —
Beta	· EA function divided into business and IT architecture teams, located on business and IT sides, respectively · Business architecture team comprised of chief architect and lead business architects for various business areas · IT architecture function includes chief architect, and lead architects for major applications	**Strategy formation** —	**Strategy formation** · Business architects only receive business strategy as input to project solution architecture design
		Strategy planning · Business architects align business requirements across projects to guide design of IT architecture · IT architects support developing target architecture for applications and technology based on required IT services	**Strategy planning** · Business architects not involved in project ideation, scoping, or planning
		Strategy implementation · Business architects design project solution architecture in terms of IT services · Business and IT architects collaborate on IT project architecture compliance reviews · IT architects highly involved in defining project solution architecture in terms of IT systems	**Strategy implementation** · Business architects highly involved in designing project solution architecture in terms of business processes and information · Business architects align data and business process design across projects and assess consistent design of project architecture solutions

Table 3. Case Descriptions

Case	EA function position and makeup	EA function role in IT design	EA function role in business design
Gamma	· EA function located within IT build sub-organization · EA function comprised of lead architect and enterprise architects for various business domains · No formal business architect	**Strategy formation** · No IT strategy	**Strategy formation** —
		Strategy planning · EA function supports planning rationalization of IT service portfolio · EA function not involved in strategic planning of IT architecture based on business strategy as IT lacks an understanding of business strategy · EA function not formally involved in project ideation and reactively assesses technical compliance of IT change requests · EA function cannot support project prioritization due to lack of IT roadmap, but supports project portfolio management by assessing projects compliance with EA principles · EA function designs high-level project architecture	**Strategy planning** —
		Strategy implementation · EA function assesses project architecture conformance to technical standards prior to and during project execution, but there are no well-defined EA principles yet · EA functions highly involved in project solution architecture design	**Strategy implementation** —
Delta	· EA function located within IT plan sub-organization · EA function comprised of chief architect, domain architects for various business domains, and technology architect · No formal business architect	**Strategy formation** · EA function involved in defining IT strategy by assessing strategic options · EA function defines initiatives for reducing IT landscape complexity · EA function accountable to identify potentials of emerging IT trends	**Strategy formation** —
		Strategy planning · EA function supports developing IT target architecture and roadmap based on business and IT strategic initiatives · EA function involved in projects ideation and scoping · EA function consulted for project portfolio management by conducting project architecture feasibility checks and providing input for projects sequencing	**Strategy planning** · EA function involved early in planning business initiatives with IT implications · EA function is influential on the design of business processes
		Strategy implementation · EA function assesses projects architecture conformance to target architecture, roadmap, and EA principles prior to and during project execution	**Strategy implementation** —

Table 3. Case Descriptions

Case	EA function position and makeup	EA function role in IT design	EA function role in business design
Zeta	· EA function located within IT plan sub-organization · EA function comprised of enterprise architects with application and infrastructure skills · No formal business architect	**Strategy formation** · EA function suggests IT strategic initiatives to exploit emerging IT trends	**Strategy formation** —
		Strategy planning · EA function supports developing IT target architecture and roadmap for various business domains based on business initiatives · EA function supports developing technology roadmap and target architecture for enhancing IT platform based on business initiatives and emerging IT trends · EA function involved in project ideation, project scoping, and architecture scenario assessments · EA function designs high-level project architecture	**Strategy planning** · EA function involved early in planning business initiatives with IT implications · EA function influential on the design of business processes
		Strategy implementation · EA function assesses project architecture conformance to roadmap and EA principles prior to and after project execution	**Strategy implementation** —
Theta	· EA function located within IT plan sub-organization · EA function comprised of enterprise architects, each focused on a major application · No formal business architect	**Strategy formation** —	**Strategy formation** —
		Strategy planning · EA function supports refining IT strategy · EA function supports planning IT landscape rationalization · EA function not involved in strategic planning of IT architecture based on business strategy as IT lacks an understanding of corporate operating model and business strategic initiatives · EA function not involved in project ideation and only reactively assesses IT change requests against technical standards · EA function prepares high level project architecture	**Strategy planning** —
		Strategy implementation · EA function assesses project architecture compliance prior to and during project execution, though there are no clear EA principles yet · EA functions highly involved in project solution architecture design	**Strategy implementation** —

Table 3. Case Descriptions

Case	EA function position and makeup	EA function role in IT design	EA function role in business design
Kappa	· EA function divided into business and IT architecture teams located on business and IT sides, respectively · Business architecture team comprised of business architects for various business domains · IT architecture team comprised of chief architect, information architects, and technology architect	**Strategy formation** · IT architects suggest initiatives to enhance IT landscape based on emerging IT trends and IT architecture complexity	**Strategy formation** · Business architects provide feedback on business strategy based on business strategy impact analysis · Business architects informally suggest strategic initiatives to reduce complexity of organizational structure and business processes and their improvement based on best practices and standards
		Strategy planning · IT architects support IT delivery managers with developing delivery area target architecture and roadmap based on business strategy and emerging IT trends · IT architects support defining and scoping business-driven IT projects · IT architects support IT delivery area managers in defining IT projects enhancing IT platform · IT architects consulted for project portfolio management by conducting project architecture feasibility checks and providing input for project prioritization	**Strategy planning** · Business architects support operationalizing business strategy into target architecture for business processes, information, and organizational governance · Business and IT architects drive business process standardization and integration discussions · Business architects support defining and scoping business projects based on business strategy and roadmap · Business architects design high-level business projects architecture
		Strategy implementation · IT architects assesses project architecture conformance to EA principles and current and target IT architectures	**Strategy implementation** · Business architects guide the design of business projects solution architecture and ensure their consistent design
Sigma	· EA function divided into business and IT architecture teams located as staff function to CEO and within IT organization , respectively	**Strategy formation** · IT architects formulate initiatives for rationalizing IT service portfolio	**Strategy formation** · Business architects support business model development by providing knowledge of external environment and internal resources and offering strategic options
		Strategy planning · IT architects plan IT landscape based on business strategy · IT architects involved in IT project definition	**Strategy planning** · Business architects support redefining business capability elements based on new business model · Business architects involved in business project ideation and project definition, analysis, and high-level project architecture design
		Strategy implementation · IT architects review project architecture compliance	**Strategy implementation** —

4.2. Cross-Case Analysis

We found the EA function in all eight cases to be responsible for ensuring coordinated design and evolution of EA; however, we noticed significant differences in scope of activities and support for various strategic change processes. Using two factors, we divided the cases into five groups. The first factor that distinguished the cases from one another was EA scope, indicating those variables for which enterprise architects had design authority. In line with our suggested taxonomy, we identified the breadth of EA function responsibilities limited to three EA scopes. In its simplest form, EA scope covered IT components; in an extended form, EA scope also comprised business processes, information assets, and occasionally organizational governance structure and processes; and in its most comprehensive form, EA scope also included the business model and business strategy. After categorizing cases based on EA scope, we conducted a pair-wise comparison between the cases in each group. Although we identified several factors that differentiated the cases from each other, we recognized one highly relevant factor for mapping the cases against the proposed taxonomy. This factor indicated EA function influence on the design of architectural elements external to its associated EA scope.

We used the two differentiating factors to map the cases based on their EA scope as presented in Figure 3. The solid circles denote the current EA scope of the cases and the dotted circles represent their previous or intended scope. The arrows indicate the change in EA scope. The next subsections describe the five identified groups in terms of EA function characteristics and EAM applications by merging the convergent data of associated cases. We also discuss our arguments for the mapping shown in Figure 3. We close this section by presenting the main findings from the cross-case analysis.

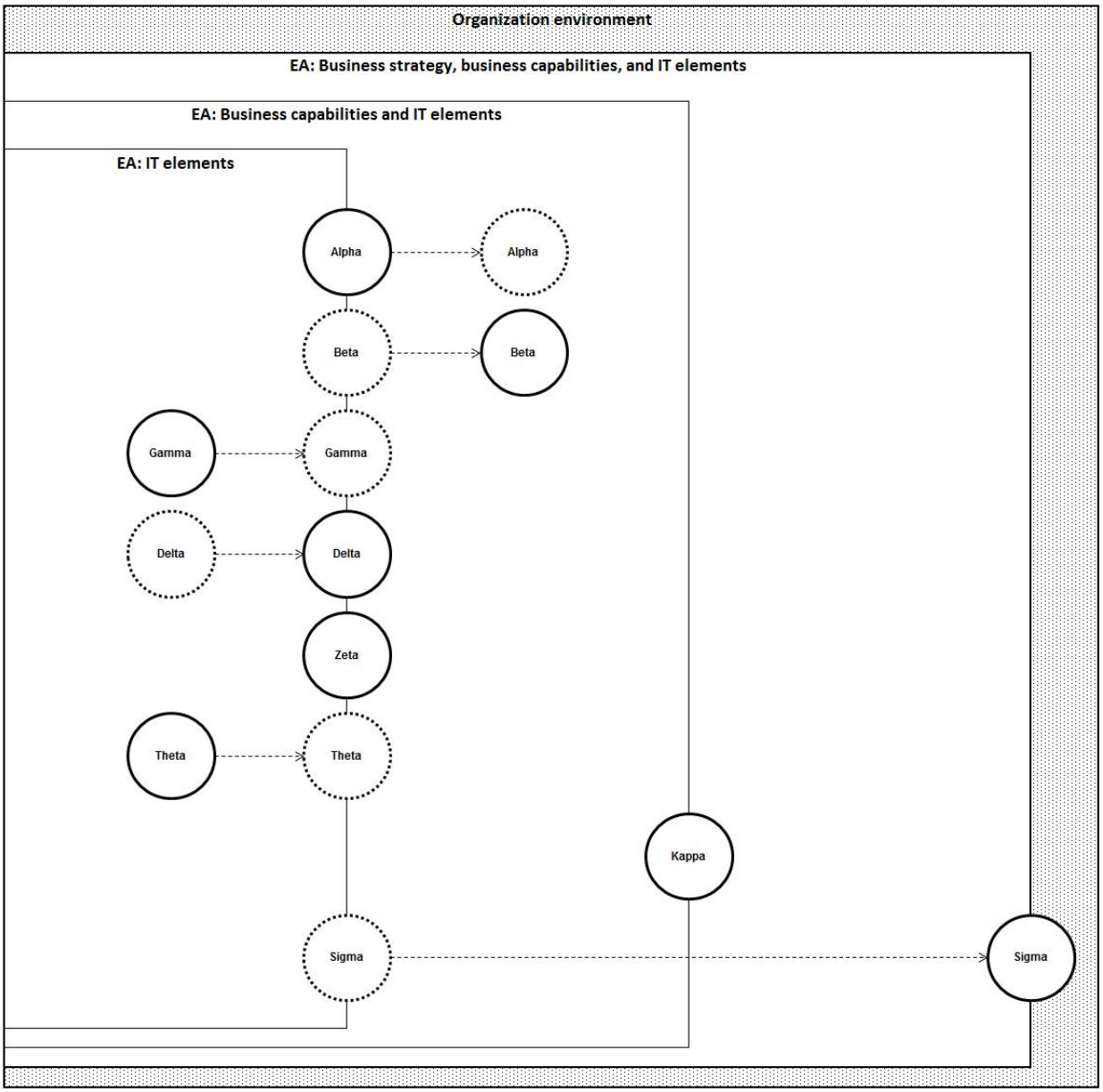

Figure 3. Mapping Cases based on EA Scope

4.2.1. EA Scope: IT Elements

EAM in Alpha, Gamma, Delta, Zeta, and Theta is IT-centric. The perspective on EA in these cases is consistent with Ross's (2003) view of IT architecture, considering it as the organizing logic for application, data, and infrastructure technologies. Therefore, mapping them to the proposed taxonomy, we place them in the first category as illustrated in Figure 3. In all these cases, the EA function is perceived as an IT function and its responsibilities are constrained by IT function boundaries. The EA function is responsible for guiding the design and evolution of IT architecture and managing its complexity. The EA function is

comprised of enterprise IT architects with skill sets typically pertinent to application, technology, and data. There is no enterprise business architect in charge of business architecture design, implying that business architectural components are only context variables for which the EA function has no design authority. Yet, in all these cases, enterprise IT architects emphasize the need for business understanding to place technology design in the context of business objectives and requirements. However, we identified differences among these cases with respect to enterprise IT architects' knowledge of and influence on business context and requirements, which impacted their effectiveness in managing IT architecture. The next subsections describe characteristics of the two groups.

EA function: Receiver of IT change requests

The approach toward EAM in Gamma, Theta, and formerly Delta resembles the standardized technology stage of Ross's (2003) EA maturity model, where the goal is to rationalize IT. In these cases, we did not find the EA function involved in strategy formation, simply because there was no significant IT strategy. We found the EA function mainly responsible for supporting operationalizing and planning of one major IT objective: reducing IT landscape complexity by eliminating duplicated and less efficient services. Long-term IT strategy planning based on business strategy is not present either. Enterprise IT architects are involved late in the planning process for IT-related business initiatives and only receive quite matured IT change requests to assess their technology choices. The EA function then supports IT project solution design and implementation by preparing high-level project architectures and assessing project solution architecture compliance with existing architecture and technical standards. As predicted by Heiß (2015), lack of a holistic plan for IT architecture evolution has reduced the role of enterprise IT architects to providing expertise in developing project solution architecture and managing technology standards. Late involvement of enterprise IT architects in planning IT-related business initiatives has also negatively impacted their influence on business decisions with IT implications and therefore managing IT architecture evolution.

As also suggested by Henderson and Venkatraman (1993) and Teo and King (1997), enterprise IT architects in these cases associate their late engagement in planning business initiatives to the perception of IT in the organization. In both organizations, IT is perceived only as a service provider responsible for delivering IT solutions. Completely aware of their low EAM maturity, these EA functions are demanding earlier involvement in business strategic initiatives to proactively plan and better manage changes to IT

architecture. Delta has already succeeded in this transition and as a result, the EA function has been moved to the IT plan sub-organization from its prior position within IT build.

EA function: Influences business strategy formation and planning

In Alpha, Delta, and Zeta, the EA function is either located in the IT plan sub-organization or as a staff function to the CIO. Like Gamma and Theta, enterprise IT architects are responsible for architectural compliance assessment of IT projects prior to and during implementation. Furthermore, we found them relatively more engaged in IT strategy formation by facilitating situation analysis and developing and analyzing strategic initiatives. Enterprise architects also actively formulate strategic initiatives to reduce complexity of the IT landscape and improve its performance in line with emerging IT trends. Having a holistic understanding of IT architectural components and their relationships, they also support translating IT strategic initiatives to tactical plans.

In addition to planning IT strategic initiatives, enterprise IT architects are highly involved in strategic planning of IT based on business strategy. The EA function facilitates or even holds responsibility for operationalizing business strategic initiatives into IT target architecture, roadmaps, and projects. Indeed, business strategic planning and IT strategic planning processes are integrated, which enables enterprise IT architects to influence business decisions with IT implications. In this way, enterprise IT architects are not merely the recipients of IT change requests, but are involved early in bringing IT project ideas to maturity by clarifying relations between business and IT architectural elements. This not only enables enterprise IT architects to better manage the complexity of IT architecture, but also allows them to consult for new and improved use of IT services for realizing business objectives and enhancing business capabilities. We found enterprise IT architects in Delta and Zeta especially influential in the design of business processes and information assets. Enterprise IT architects in Alpha are even driving business capability standardization to enable standardization of the IT portfolio. In addition to enterprise IT architects' influence on the business strategy planning process, we found that chief enterprise IT architect in Alpha consulted for business strategy formation to clarify IT implications of business strategic options. Therefore, in Figure 3, we decided to locate Alpha, Delta, and Zeta on the edge of the box to indicate their influence on business components external to IT boundaries.

Enterprise IT architects in these three cases suggest that their organization's view of IT as a business enabler has allowed their early involvement in planning business initiatives (Teo and King, 1997). Enterprise IT architects' influence on business architectural elements supports the view that suggests making technology work requires a wider perspective than technology only, whereby contextual aspects are included in the design perspective to optimally match context and technology (Hoogervorst, 2004; Ross, 2003). Yet, constrained by IT function boundaries, enterprise IT architects in none of these cases have control over the design of business architecture. Uncoordinated business development efforts across corporate business units still negatively affect the management of IT architecture complexity. Alpha suggests that extending the EA function to the business side will empower architects to formally govern integrated design of business and IT.

4.2.2. EA Scope: Business Capability and IT Elements

In Beta and Kappa, we found that the EA function was responsible for business architecture management activities in addition to guiding IT architecture design. The EA function not only has authority over the design of IT elements, but also some of the elements realizing business capabilities. The most noticeable difference between these cases and IT-centric ones is the presence of enterprise business architects. The responsibility for EAM is divided between business and IT architecture teams situated within the business and IT sides of the organization. While enterprise IT architects focus on managing the evolution of IT architecture, enterprise business architects ensure coordinated design of business processes, information assets, and organizational governance structure. Therefore, we locate these cases in the second category where EA scope extends to cover business capability elements. Responsible for guiding the design of business capability elements, enterprise business architects in both organizations highly emphasize the need for understanding business strategy. However, we observed differences between Beta and Kappa with respect to the extent of their influence on business strategy. The next two subsections describe EAM activities in each case.

EA function: Receiver of business projects

In Beta, the business architecture team is highly involved in business project solution design to specify business processes, information assets, and IT services based on business requirements. Enterprise business architects also coordinate the design of projects solution architecture and ensure their

consistency. Consistent design of business processes, information assets, and IT services across various projects in turn better enables management of IT architecture complexity. Indeed, EA function was extended from IT to the business side to facilitate better understanding of business requirements for defining IT services. The relocation then empowered enterprise business architects to also govern the design of business processes and information assets.

While highly engaged in business strategy implementation, enterprise business architects are not involved in long-term visioning of business architecture and defining and planning business projects. They have no influence on the formation or planning of business strategy and only receive it as a taken-for-granted input directing the design of business processes and information assets.

EA function: Influences business strategy formation

Like Beta, enterprise business architects in Kappa guide the design of business project solution architecture in support of business strategy implementation and their conformance to business and architectural principles. However, their responsibilities also extend to cover planning of business strategy. Having a holistic understanding of business architectural elements and their relationship, enterprise business architects in Kappa facilitate operationalization of business strategic initiatives into target architecture for information assets, organizational governance structure, and business processes. They also support defining the roadmap and required projects for realizing the target architecture. Horizontal connections between enterprise business and IT architects enable integrated planning of business and IT capabilities. As an example, enterprise business and IT architects in Kappa are jointly driving standardization and integration of business processes, data assets, and IT systems across corporate business units. Therefore, the concept behind EAM in Kappa is similar to the Versteeg and Bouwman (2006) perspective, in which business strategy and business model are inputs for development of business processes, information assets, organizational governance, and IT components.

Although not formally invited to strategy meetings, enterprise business architects in Kappa see themselves influencing the business strategy formation process. Tightly engaged with senior business managers, they provide feedback on business strategy based on its implications for business processes and organizational governance structure. They also provide input to business strategy formation based on their knowledge of performance of business architectural elements in realizing business capabilities.

Responsible for managing complexity of corporate business processes and the governance model and aware of industry best practices, enterprise business architects also suggest business redesign initiatives. Therefore, in Figure 3 we chose to locate Kappa on the edge of the box to indicate EA function influence on business strategy.

4.2.3. EA Scope: Business Model, Business Capability, and IT Elements

In Sigma we observed the most advanced application of EAM. The EA function not only governs the design of business capability and IT components, but is also formally involved in developing the business model. Therefore, having business strategic elements as design variables for EAM activities, Sigma represents the most comprehensive EA scope where the EA function covers the design of all organizational facets. While the EAM goal in Sigma was previously limited to governing the evolution of IT architecture, market volatility necessitated strategic agility and encouraged application of EAM for developing business strategies. Enterprise business architects highly emphasize understanding the organization's external environment to guide its innovative development. The next subsection describes EAM activities in Sigma.

EA function: Supports defining business strategy

In Sigma, the EA function is divided into the business architecture team positioned as a staff function to the CEO and the IT architecture team located in the IT organization. Constantly specifying and questioning the organizational situation in relation to its internal resources and external environment, enterprise business architects are involved in business strategy formation. Enterprise business architects facilitate redefinition of the business model in alignment with customer requirements, competitor behavior, emerging technological trends, and business and IT capabilities. Enterprise business architects also support business strategy planning by clarifying and communicating implications of a new business model for business and IT execution elements such as business processes, managerial practices, organizational governance model, and IT resources. They also take part in defining and scoping projects realizing the business strategy. In this way, enterprise business architects ensure coherency between business strategy formation and planning processes.

Possessing an understanding of market dynamics, enterprise business architects not only support adjusting the business model to market requirements, but also actively devise strategic initiatives to foster

innovation by influencing the organization ecosystem. Drawing on their comprehensive understanding of corporate customer requirements, competitor offerings, and emerging technologies, business architects have suggested several unconventional offerings that were disruptive to Sigma's competitors. Therefore, in Figure 3, we chose to place Sigma on the edge of the box to indicate its influence on the organization's environment.

4.3. Summary of Findings

The eight case studies empirically supported the taxonomy derived from our literature synthesis in terms of EA scope. The study by Radeke and Legner (2012) also provided grounding for better articulating EAM applications. To ensure coherent and consistent design of an enterprise, and depending on enterprise boundaries, EAM may be used to support processes for IT strategy formation, planning, and implementation; business strategy planning and implementation; business strategy formation; or a combination of these.

While EA scope defines variables controllable by enterprise architects, the empirical findings indicate the importance of understanding the external environment for managing EA. This observation is in line with Rood (1994), which suggests that EA must be developed with environmental forces in mind. We can explain this finding by taking a systems view toward an enterprise. Systems theory suggests that as an open system is not independent from its ecosystem, controlling and understanding its behavior not only require understanding its operations, but understanding its broader surrounding context (Gharajedaghi, 2011). Gharajedaghi (2011) further explains that as knowledge about the environment increases, so does the ability to convert uncontrollable variables to those that can be influenced. This is consistent with our findings from more mature cases where enterprise architects not only understood the environment in order to plan EA evolution accordingly, but also actively attempted to influence it to better manage EA evolution. This suggests that the environment is not entirely a context variable for EAM activities. Enterprise architects manage the evolution of EA not only in sequential alignment with the environment but also by influencing—not controlling—design of elements external to EA scope. This finding is also consistent with Hoogervorst (2004), suggesting the need for mutual consistency between the main design domains of an organization. In the next section, we use this finding to revise the taxonomy.

5 EA Taxonomy

Combining findings from the literature synthesis and case studies, Table 4 presents our taxonomy of EAM goals and applications according to three perspectives on EA scope among researchers and practitioners. The archetypes are labeled according to the organizational process or function EAM may support. Each archetype includes and transcends EA scopes and EAM goals and applications in previous archetypes.

Table 4. Taxonomy of EAM Applications based on EA Scope

	IT management	Business capability management	Business strategy management
EA scope	IT elements	Business capability elements	Business strategy elements
EAM goal	Coherent and consistent design and evolution of IT elements in mutual alignment with business strategy and capabilities	Coherent and consistent design and evolution of business capabilities realization elements in mutual alignment with business strategy	Coherent and consistent design and evolution of business model in mutual alignment with market environment
EAM application	Complements IT strategy formation, planning, and implementation Influences business strategy formation and planning	Complements business strategy planning and implementation Influences business strategy formation	Complements business strategy formation

In its simplest form, EAM supports an organization's IT management. When EA scope is limited to IT elements, organizations adopt EAM to ensure coherent and consistent design of IT systems (Hoogervorst and Dietz, 2013). Therefore, enterprise architects are involved in processes for IT strategy formation, planning, and implementation to ensure coordinated acquisition, development, and implementation of IT systems. When it comes to IT strategy formation and planning processes, enterprise IT architects facilitate IT situation analysis, developing and analyzing strategic scenarios, operationalization of business and IT strategic initiatives into IT target architecture and roadmap, and IT project definition and planning. Having a holistic understanding of IT architecture, enterprise IT architects may also devise architecture initiatives to reduce complexity and exploit emerging IT trends. Regarding IT strategy implementation, enterprise IT architects complement project review processes by assessing project architectural conformance to EA principles and existing and target IT architectures. As enterprise IT architects have no formal responsibility for governing the design of business architecture, the EA function is located within the IT organization and comprises architect roles covering application, data, and technology components of EA (Graves, 2008). While business strategic initiatives and required capabilities are inputs for IT architecture design,

architects may still influence business architectural elements to better manage IT architecture complexity and enable IT-driven business innovations.

In a more comprehensive perspective toward EA, EAM supports business capability management. When EA scope extends to cover business capability elements, the EAM goal is to ensure coherent and consistent design of business capability elements in integration with IT components (Hoogervorst and Dietz, 2013). The EA function formally supports business strategy planning process by facilitating operationalization of business strategy into target architecture for business capability elements, and definition and planning of projects based on their contribution to strategic objectives and architectural constraints and interdependencies. The EA function is also responsible for assessment of project architecture consistency in design and conformance to EA principles prior to, during, and after project implementation. Enterprise business architects are now part of an EA function that is spread between business and IT organizations. Situating enterprise business architects on the business side enables their better understanding of the business context as well as their authority for guiding business architecture design. Business strategy and strategic initiatives are inputs for design activities. However, enterprise business architects may still influence business strategy by explicating its impact on business capability elements (Wolfenden and Welch, 2000), providing input about performance of business capability elements in meeting business objectives, and suggesting initiatives to improve business architecture performance.

In its most comprehensive form, EAM facilitates business strategy management. When EA scope covers strategic components of business, EAM ensures coherent business model design in integration with business capability and IT elements (Hoogervorst and Dietz, 2013). The EA function supports formation of the business strategy and business model — as the conceptual blueprint of business strategy — in alignment with external environment and internal resources (Simon et al., 2014). EAM complements this process by facilitating situational analysis of the organization in relation to its environment, and development and assessment of strategic options. The EA function also formally supports devising initiatives to reduce the complexity of architecture and improving its performance in line with industry standards. With an understanding of market dynamics, enterprise business architects also enable innovation by facilitating development of strategic scenarios that bring the organization's ecosystem in line

with strategic goals (Lapalme, 2012). To enable enterprise business architects' participation in business strategy formation, they are situated close to executive managers (Graves, 2008).

6 Discussion

Findings from the literature review and case studies show three perspectives on EA scope among researchers and practitioners. This study used the three identified views of EA scope to classify EAM applications in organizations. The taxonomy suggests that an EA scope limited to IT components restricts EAM applications to supporting IT strategy formation, planning and implementation; an extension of EA scope to cover business capability elements enables EAM to also support business strategy planning and implementation; and extending EA scope even further to cover business strategic elements turns EAM into a systematic approach supporting all of the above processes and business strategy formation. In other words, depending on EA scope, an organization may use EAM to support IT management, business capability management, or business strategy management. More importantly, the findings suggest that enterprise architects understand and influence processes external to the EA scope to better manage EA design and evolution.

Besides eliminating confusion about the EAM applications, the taxonomy assists managers to deliberately decide about adoption of the EAM concept for various strategic management processes, scope of enterprise architects' responsibilities, and integration of the EA function into organizational governance. The findings as well have three theoretical implications. First, in line with previous studies on integrating systems theory and enterprise architecture thinking (e.g., Gharajedaghi, 2011), our findings reinforce the importance of systems thinking, especially adoption of the open systems principle, for managing EA design and evolution. While EA scope defines architectural elements whose design could be controlled by enterprise architects, findings from the case studies suggest that the environment external to EA scope is not entirely a context variable. To effectively manage EA evolution, enterprise architects need to understand the enterprise environment, which potentially may allow them to influence variables external to EA scope. The systems view of the enterprise challenges the strictly hierarchical approach for EA development that starts with strategic positioning, and then derives appropriate organizational processes and structures on the strategy basis, and then finally specifies IT systems (e.g., Winter et al., 2007). As indicated in the case studies and suggested by Hoogervorst and Dietz (2013) and Korhonen (2013), a

strictly hierarchical approach fails to consider the impact of lower-level dimensions on higher-level decisions.

Second, the findings may also suggest a trend for extending EAM applications in organizations. In other words, organizations adopt EAM to support various strategy management processes, and as the EAM concept becomes more mature, its applications are extended to a wider range of processes. This proposition is consistent with the US Government General Accountability Office (2010) framework for assessing and improving EAM in which EAM use is one dimension for distinguishing among stages of EAM capability maturity. However, as illustrated in Figure 3, not all studied organizations have extended their EAM application in the same manner. This finding may indicate the influence of contingency factors on the evolution path and reinforce situational EAM studies suggesting that the EAM development path is organization specific (e.g., van der Raadt and van Vliet, 2009). We noticed industrial sector and business governance model differences between IT-centric EAM cases and those that adopt EAM for business management. In all three cases where EAM supports business strategic management processes, we found a relatively more centralized approach toward business governance. In addition, two out of these three cases belong to the financial sector. While centralized business governance may have facilitated a coordinated approach for governing business architecture development, the industrial sector may have necessitated strategic agility and therefore the need for a systematic approach for business development in these organizations. This observation is consistent with Haki et al.'s (2012) findings from four case studies in which they identify the organizational structure and industry type influential in EAM adoption.

Third, our findings also challenge the studies that associate enterprise architects solely with an IT identity. Gartner (Blosch and Burton, 2014) argues that as growth in the digital economy is increasing the importance of IT in organizations, enterprise architects are demanding involvement in business development activities to enable exploitation of emerging IT trends. While Gartner acknowledges the changing role of enterprise architects from supporting IT management toward business strategy management, enterprise architects' contribution to business development remains limited in that they provide only an IT perspective. However, our findings suggest that enterprise architect involvement in business strategy management is not limited to leveraging digital economy opportunities. By providing a comprehensive view of the organization in its environment, enterprise architects support developing business strategy in alignment with a broader range of competitive and market forces.

While only a few studies suggest a classification for EAM applications, the taxonomy proposed in this paper is different from the earlier ones. Ross et al. (2006) suggest a maturity model for EA where EAM governs the design of an organization's business processes, data assets, and IT systems. However, considering business strategy as a taken-for-granted input for design activities, their model suggests EAM as a tool supporting execution of business strategy and overlooks the broader application of EAM for business strategy formation. Lapalme (2012) also introduces three schools of thought on EAM; however, the proposed taxonomy is not grounded on empirical evidence. In addition, Lapalme's taxonomy simply divides EA into IT and business architectures where business architecture comprises all facets of an organization. However, building upon an extensive literature review and real-world evidence, our study distinguishes between two different views of business architecture. Lapalme (2012) also associates system-in-environment thinking with the most mature application of EAM in governing design and evolution of an entire organization, whereas our findings suggest that effective management of EA evolution requires system-in-environment thinking irrespective of EA scope.

7 Conclusion

A growing body of academic and practitioner literature has researched EA and EAM. We identified widely different perspectives on the term EA, which in turn had given rise to different views of EAM goals and applications in organizations. In this study we clarify the EA terminology; and drawing on findings from a literature synthesis and case studies, we propose a taxonomy that classifies EAM applications based on three recognized perspectives of EA scope. The taxonomy suggests that EAM can facilitate IT strategy formation, planning, and implementation; business strategy planning and implementation; and business strategy formation, depending on whether EA scope covers IT, business capability, or business strategic elements of an organization. The empirical findings further underline that because an enterprise as an open system is not independent from its environment, managing the evolution of EA requires understanding and even influencing the design of architectural elements beyond the EA scope.

While our study provides valuable insights into diverse applications of EAM in organizations, there are certain limitations. The theoretical and empirical findings support the three proposed archetypes of EAM applications, but more in-depth studies are necessary to refine our findings and further characterize the three archetypes in terms of EA function makeup, its integration into organizational governance, and

professional and personal competencies of enterprise architects. Eventually these characteristics can be used to enhance and extend the maturity models for assessing EAM capability. Next, our empirical studies demonstrated examples of EAM methods used to support various stages of the strategy management process; however, further research is needed to provide a more comprehensive understanding of these methods. Finally, while our case studies indicate that organizations seek different goals and applications by adopting EAM, more detailed studies are needed to investigate contingency factors that influence organizations' use of EAM. The current study also indicates a trend for advancing EAM application in organizations and various pathways for its evolution. This will inspire further studies for exploring contingency factors that encourage organizations to extend EAM application and for investigating factors that influence the path of evolution.

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