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A resource-based perspective of value generation through enterprise architecture management

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ABSTRACT

Our study contributes to the nascent discourse on enterprise architecture management (EAM) benefits by proposing a theory-led, empirically validated model to explain how EAM benefits unfold. Drawing on the resource-based theory, and based on empirical insights from 8 case studies, we find that EAM does not create benefits per se, but only creates value if an organization develops four second-order EAM capabilities – EA modeling, EA planning, EA implementation, and EA governance. The discovery that EAM resources only unfold their potential when forming EAM capabilities casts doubt on the established practice of initiating EAM as a modeling and documentation endeavor.

1. Introduction

Enterprise architecture management (EAM) evolved as a discipline in the late 1980s after Zachman [1] had applied architecture concepts from constructional engineering to design and plan corporate information systems (IS). EAM advocates an integrated view of the enterprise from a business and IT perspective, its to-be state, and the way to get there [2]. The structured planning and improved decision-making based on enterprise architecture models are presumed to provide various benefits, including an aligned IT and, consequently, increased firm performance [3,4]. In particular, existing research points toward positive effects on project portfolio management, regulatory compliance, risk mitigation, IT cost reduction, and others [5]. More recently, EAM has increasingly been applied to facilitate and guide business transformation [6–8], thus making it an important instrument for organizations embarking on a digital transformation journey.

While there is a relative consent that these benefits may be the outcome of successful EAM, the mechanisms that lead to their realization are widely unexplored. However, extending the current understanding of the mechanisms of EAM benefit realization is highly worthwhile both from a practical and a theoretical point of view. In practice, EA programs have very often turned out to struggle in realizing these benefits [9,10]. An additional difficulty is that EAM's positive effects are hard to measure and justify, and often only appear on a global scale [11,12]. Practitioners will not be able to learn from positive examples of EAM benefit realization as long as the exact conditions responsible for success in these cases remain unclear. Only if such conditions are known will practitioners be able to reliably implement successful EAM by taking corresponding precautions, and by drawing executives' attention to the importance of providing necessary resources. Understanding the mechanisms of successful EAM will thus be crucial for making the realization of these benefits reproducible and thereby more reliable.

From a theoretical point of view, academics have long called for in-depth studies with a clear theoretical foundation to clarify relevant causal relations [5,13]. Even though a nascent academic discourse has evolved that mostly identifies more or less related lists of EAM success factors [3,9,14,15], it can still be observed that existing literature on EAM's value-generating mechanisms generally suffers from over-simplification [16], and the occurrence of certain EAM success factors is left mostly unexplained. Moreover, the *process* of EAM value generation is mostly being neglected. Addressing this gap, our aim is to provide a comprehensive, theoretically and empirically grounded answer to the following research question:

How does EAM generate value for firms?

To study EAM's value-generating mechanisms, we use the resource-based theory (RBT) as a theoretical lens [17,18]. The RBT has been applied successfully to explain how value is generated through the use and management of IT [19–22], and scholars have suggested using it to analyze EAM [23–25]. In this study, we opt for multiple exploratory case studies to investigate the resources and capabilities developed with EAM and analyze how they improve existing IS capabilities. We

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contribute to the advancement of the EAM discipline in two significant ways: (1) By drawing on the RBT, we develop the theoretical foundations and a research framework for understanding EAM's value-creating mechanisms, and (2) based on empirical insights from 8 case studies, we suggest a model of EAM value generation. This model identifies EAM resources and capabilities, as well as causal relations elucidating their impact on other IS capabilities.

The article is structured as follows: Section 2 briefly reviews prior research and outlines the research gap. In Section 3, we describe how we apply the resource-based perspective to derive a research framework that tentatively structures EAM's value generation. In Section 4, we present our research method, which includes a description of our 8 cases, the qualitative data analysis and how we cater for the required quality guidelines. Subsequently, we synthesize our empirical findings into a set of propositions describing how value is generated through EAM (Section 5). Section 6 provides a discussion of the findings and their implications for practitioners, EAM research, and the RBT. We conclude with a summary and an outlook on future research (Section 7).

2. Prior research on EAM benefits and value generation

Despite EAM's increasing popularity, understanding the value generation, and the benefits resulting from EAM remains a challenge for both researchers and practitioners. This results in a relatively young field of research, which has emerged over the past fifteen years. Extant studies identify a wide range of EAM benefits, ranging from the effective management of organizations' IT infrastructure, services, applications, and data ([26], p. 192; [27]), better project risk management, and increased software component reuse ([28], p. 14) to high-level impacts such as IT flexibility and IT efficiency [12,13], strategic agility [27], better external relationship management [29], and higher business-IT alignment levels [27,30]. More recently, EAM's business transformation support has been highlighted [8,31,32], giving it a prominent role in the current wave of digitalization. In 2010, Boucharas et al. published a systematic review of scientific and practitioner literature, concluding that "although on the whole the (mostly practitioner-oriented) literature displays an abundance of potential EA benefits, these are mostly inconsistently scientifically grounded" (p. 2). In the meantime, more researchers have embraced the topic, and existing studies can be classified into four streams (see Table 1) discussed in the following paragraphs.

Early studies on EAM value generation focus particularly on the *identification and measurement of benefits* (stream 1). They are often explorative by nature and use structured literature reviews [5], expert interviewing, or surveys [33,34]. The outcomes are different categories of (potential) EAM benefits and frameworks for measuring these benefits ([35–37]), but do not go any further to analyze cause-effect relationships. They also mostly lack theoretical underpinnings beyond mere references to prior work on the topic.

A more advanced stream considers *practices, or processes, as the source of EAM benefits* (stream 2). An early attempt is the study by Boh and Yellin [26], who focus on the use of EA standards. Thereafter, Foorthuis et al. [41] investigate the relationship between certain EA practices and some of the aforementioned EA benefits. Many of this stream's studies capture EAM through a single construct like EAM maturity, linking it directly to one or several benefit categories [11,13,27,38]. Using survey and statistical analyses, they show that the application of EAM produces beneficial outcomes, but because of the conceptual model's simplicity, they are unable to explain value generation mechanisms in more detail. Moreover, they mostly do not apply a consistent theoretical lens for their investigation.

In recent years, several authors have proposed more comprehensive models to explain why and how EA leads to benefits (stream 3). These *benefit realization models* acknowledge that EAM value generation is complex and may involve several steps to unfold. For instance, Tamm et al. [4] introduce the idea of a two-step realization process based on benefit enablers. Other models are inspired by and based on the IS success model [46] and use constructs like *EAM service and product quality* to explain EAM's benefits. For instance, Lange et al. (2012) suggest an EA benefit realization model, refining the IS success model through literature reviews and exploratory interviews. In their subsequent study, Lange et al. [3] empirically validate an EAM success factor model that explains the key factors and measures of EAM success through literature reviews and exploratory interviews. Based on empirical data from a cross-sectional survey, they confirm that four distinct success factors – EAM product quality, EAM infrastructure quality, EAM service quality, and EAM organizational anchoring – have an impact on the intention to use EA and on the benefits of using EA at the organizational and project levels. Their results emphasize the role of 'EAM organizational anchoring' as a core focal concept mediating EAM success. Taking a similar approach, Niemi and Pekkola [15] posit that benefits result from EA process quality, EA product quality, EA service quality, and a favorable EA social environment. In a more recent empirical study, Shanks et al. [42] exclusively focus on investigating the impacts of EA service quality.

The fourth class of studies investigates *context and success factors that impact EAM benefit realization* (stream 4). Here, researchers investigate which particular conditions (e.g., culture) can foster or hinder value generation. While some studies use a clear theoretical framework [43], others work with rather unrelated lists of success factors [9,14,45]. Not surprisingly, many of them are exploratory and lack a sound theoretical underpinning. Moreover, these papers do not explain how exactly the success factors influence EAM's success.

From our literature review, we conclude that there is a nascent discourse on EAM benefits and value-generating mechanisms. While earlier studies have focused on identifying EAM benefits and on empirically confirming them, their research design is mostly exploratory, and their lack of theoretical foundation limits their explanatory power. As also diagnosed in a recent systematic literature review by Gong & Janssen [16], existing literature on EAM's value-generating mechanisms generally suffers from theoretical oversimplification. To date, the causal relationships and processes behind EAM value generation have not been studied in great detail, nor have they been provided with a solid theoretical foundation.

3. The resource-based theory as a lens to study EAM

To understand EAM's value-creation mechanisms, we suggest the RBT as a promising theoretical lens for several reasons: The interaction between IT and other organizational resources and their contribution to generating business value have repeatedly been part of the resource-based discourse [19,47,48]. As a mature research stream, the RBT makes it possible to rely on an established causal chain of value generation by a company's IT resources and capabilities [21]. Moreover, the RBT enables us to not only explain competitive advantage, but also performance effects by means of different efficiency levels [49]. This may be valuable to explain differences in EAM value generation across different enterprises.

According to the RBT, a company's strengths and weaknesses are based on its resources, which can lead to a sustainable competitive advantage if they are valuable, rare, inimitable, and non-substitutable [17]. From the perspective of RBT, a firm's capacity to deploy resources, its so-called *capability*, is even more important than its resources [50]. Consequently, the RBT distinguishes between *resource picking* (i.e., the selection and acquisition of suitable resources) and *capability building* (i.e., the ability to exploit suitable resources' inherent potential) as two core firm mechanisms ([51], p. 389).

We draw on the existing RBT-based body of knowledge on value generation through IT [21,22,52] as a conceptual foundation, to understand the impact of EAM on IS capabilities and to derive our initial research model. Examining EAM literature from an RBT perspective, we

Table 1
Studies on EAM's Benefit and Success.

Article	Focus	Theoretical foundation	Empirical validation
Stream 1: Exploration and measurement of EAM benefits			
[33]	Practitioners' perspectives on key function and benefits	No specific theoretical foundation; based on prior EA literature	Exploratory survey, 376 respondents
[5]	EAM benefits	No specific theoretical foundation, based on prior EA literature	No empirical work
[34]	Exploration of (classes of) EAM goals	No specific theoretical foundations	Semi-structured interviews with 16 industry experts
[35–37]	Development of a framework for the categorization and measurement of EAM benefits	No specific theoretical foundations	Pilot test of the framework in two organizations, survey of 287 respondents
Stream 2: EAM practices and processes as source of EAM benefits			
[26]	Benefits of using EA standards and governance mechanisms that facilitate their use	Research model based on prior literature, no dominant theoretical basis	Exploratory interviews, pilot study, confirmatory survey of 90 responses
[13,38]	Financial performance and other business benefits of companies adopting EAM	No theoretical foundation; hypotheses based on prior EA literature	Questionnaire survey of 308 companies listed on Japan's stock market
[27]	EAM maturity, IT alignment, effectiveness and agility	Maturity model by Ross [39], literature on alignment	Survey of 164 respondents
[11]	EAM maturity, project success, satisfaction with IT	No specific theoretical lens	Survey of 90 respondents
[40,41]	EAM practices and benefits	Existing literature on EAM practice and their benefits	Survey of 293 respondents
Stream 3: Benefit realization models			
[4]	Basic EA benefits model linking EA quality to EA benefit enablers and organizational impact	Research model derived from prior EA literature	No empirical validation
[12]	IT flexibility and efficiency through EAM	Research model is based on city-planning paradigm and prestudy, no dominant theoretical basis	Expert interviews with EAM managers of 14 Swiss and German banks, field survey (international financial service industry) of 85 respondents
[3]	EAM success factor model	DeLone and McLean's IS success model to derive initial constructs	Empirical validation based on a survey of 117 respondents
[15]	EA process/product/service quality, social environment, and their impact on EA results and benefit realization	Mostly data-driven model development, existing models of EA benefit realization, use of DeLone and McLean's IS success model	Single case study with 14 interviews
[42]	EA service quality	Research model derived from literature analysis and interviews with experts and focus groups	Cross-sectional survey with 192 EA-experienced CIOs
Stream 4: EAM context and success factors			
[43]	Organizational culture as a moderator of the way EAM unfolds value	Cultural archetypes by [44]	Empirical validation based on a survey of 138 respondents
[9]	Exploratory investigation of the organizational factors and challenges influencing EAM success	No specific theoretical foundation	Exploratory survey of 105 respondents
[14]	Analysis of EAM success factors	No specific theoretical foundation	Empirical validation based on a survey of 132 respondents
[45]	Influence of certain contextual factors on perceived EAM benefits	No specific theoretical foundations	Empirical validation based on a survey of 126 respondents

Table 2
EAM/IS resources and capabilities.

Resources and Capabilities	Definition
EAM resources	
EAM-related human resources	Any human resources taking over architectural roles like members of the architecture review boards, or enterprise architects, as well as their skills, training, and experience with EA modeling, methods, and tools.
EAM-related technological resources	Any hardware or software resources facilitating EAM by documenting and analyzing the EA, as well as providing methodical support: examples include EA tools, repositories, and management software.
EAM-related intangibles	Intangible resources (policies, rules, and knowledge assets) facilitating EAM, like EAM frameworks, standards, modeling techniques, and process models.
EAM capability	Capacity to deploy EAM resources by using a set of repeating organizational processes, like as-is analysis or target architecture design.
IS resources	
Human IS resources	Any human resources dedicated to the planning, development, and operation of IS (and IT), like software developers or business analysts.
Technological IS resources	Any technological resources, like database systems, hardware, operating systems, etc.
IS-related intangibles	Intangible resources facilitating the planning, development, and operation of IS, like development methodologies, best practices, frameworks, etc.
IS capability	Capacity to deploy IS resources by using a set of repeating organizational processes, like the execution of development and implementation projects.

find evidence that the acquisition of dedicated *EAM resources* is usually an important starting point for the introduction and development of EAM initiatives in an organization [10]. While the RBT does not prescribe any specific way of categorizing an organization's resources, it will be most useful for the present investigation to focus on the basic kinds of resources that are most relevant in the context of EAM (Table 2): (1) human beings taking over EA roles, (2) the technological assets used for documenting and analyzing a firm's EA, and (3) the standards, techniques, and process models, etc. guiding a firm's EAM, which may for the sake of brevity be summarized under the notion of EAM-related intangible resources. More specifically, *EAM-related human resources* comprise employees taking over architectural roles, as well as their skills, training, and experience (analogous to [17], p. 101). This may include modeling skills, tool knowledge, or method expertise and can be acquired through seminars, conferences, or literature. *EAM-related technological resources* refer to both hardware and software applied to EAM (analogous to [21], p. 294 f.), such as tools to document and analyze the EA, and to provide methodical support. *EAM-related intangible resources* refer to the policies, rules, and knowledge assets that a firm acquires, for instance, in the form of EAM frameworks or reference

models (analogous to Melville et al. [21]). These intangibles play an important role in EAM initiatives, which are often strongly inspired by frameworks and standards like The Open Group Architecture Framework (TOGAF) [53], or the Zachman Framework [1].

However, EAM literature has also highlighted that the acquisition of EAM resources does not add value per se: they have to be deployed to create value. We define *EAM capabilities* as a company's capacity to deploy EAM resources by using a set of repeating organizational processes (analogous to Amit and Schoemaker [50], Grant [54]; and Makadok) [51]. An EAM capability is, therefore, based on the processes in which enterprise architects, EAM tools, and EA frameworks are active, for instance, during the as-is analysis of the application landscape. These processes are mostly not independent of other IS capabilities. For instance, information about the EA may be analyzed and used throughout IS strategy planning sessions to develop a cost-efficient and flexible IS landscape. Furthermore, EAM's global perspective on an organization including its strategic objectives and its IS infrastructure obviously facilitates an organization's IS-business alignment. Examples of this kind are plentiful, which is not surprising, given that an organization's architecture has various IS resources as its elements, and EAM's processes of documentation and analysis are thus concerned with facilitating improvements of using these resources. It is, therefore, safe to posit that there is a close relationship between EAM capabilities and other IS capabilities, with the former leveraging the latter (see Fig. 1). What needs to be investigated are the fine-grained mechanisms of this relationship.

Following the RBT, we conclude that EAM's positive influence materializes in a three-step process: (1) the acquisition of EAM resources, (2) their application in organizational processes that build an EAM capability, and (3) this capability's impact on other IS capabilities. As EAM resources are generally acquired in EA initiatives' early phases, they can be easily identified. However, we know little about the nature of EAM capabilities, how these capabilities are built using the given EAM resources, and how they affect existing IS capabilities and create organizational value.

4. Research method

To further investigate EAM's value-generating mechanism, we employed an exploratory case study approach that allowed us to study the phenomenon of interest in a natural context ([55], p. 372; [56], p. 233 f.; [57], p. 18). We opted for multiple-case studies, which allow for the replication and extension of findings in individual cases ([58], p. 620). We rely on the theoretical framework of the RBT as an underpinning of our theory building from the case studies, although the initial set of constructs has a tentative status ([59], p. 536). Consequently, we focus our initial data collection and analysis on (1) the EAM-related resources within a firm, (2) the processes that exploit these resources and form the EAM capabilities, and (3) the EAM capability's impact on IS capabilities. Our unit of analysis is, of course, the organization.

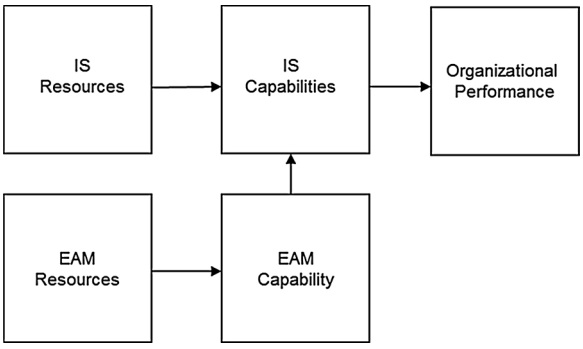

Fig. 1. Research Framework – A Resource-Based Perspective of Value Generation through EAM.

4.1. Site selection

We applied theoretical sampling to select a set of organizations that are diverse with regard to size, industry, and experience with EAM. To extend our understanding of EAM, avoid biases, and allow for the extraction of generalizable patterns ([60], p. 609; [61], p. 27), the sample comprises 8 organizations that approach EAM with different starting points and foci (see Appendix B). To analyze how different types and degrees of EAM capabilities lead to changing performance levels, we selected firms engaged in EAM for differing time spans and with varying EAM impacts on the organizational performance. We analyzed 6 firms with significant EAM experience collected over several years, and 2 firms experiencing a first round of EAM implementation at the time of the interviews. As EAM is expected to be most useful for larger firms ([12], p. 15, we restricted our analysis to firms with more than 5000 employees.

Our cases represent a broad spectrum of EAM-related challenges, starting points, and approaches. While some of the case companies suffered from high IT-related costs (i.e., Shop & Go and WorldCars), others reported low levels of business-IT alignment (i.e., FeelGood), or a long time to market (i.e., Bank4You). Across all the cases, we found a lack of transparency about the actual EA and high levels of IT/IS heterogeneity, which is an important theme, yet the approaches to solve these issues were diverse. The cases differed in terms of the EA layer on which they mostly concentrated, and the degree of centralization they had chosen. For instance, WorldCars paid much attention to the application portfolio, while giving decentral units a lot of decision-making power. In contrast, FeelGood intended to leverage economies of scale through highly standardized business processes on a global scale; thus, basically dictating the central enterprise resource planning (ERP) system of the whole organization. We also found that the implemented EAM processes differed in type and organizational reach. For instance, some firms greatly emphasized long-term planning (i.e., BeSafe), whereas others started to improve their development processes through EAM practices (i.e., AdminGroup, Tools-R-Us). Not surprisingly, the institutionalization of EAM was also diverse: some firms had very large EAM teams organized into departments very close to the top executives, whereas other firms had not yet gone beyond the stage of EAM as a project. In line with these differences, the enterprise architects' decision-making power also differed. While some firms allowed their architects to make far-reaching decisions (i.e., FeelGood), other firms defined the architect's role as merely that of a consultant (i.e., AdminGroup).

4.2. Data collection

Primary data were collected through interviews and complemented with an analysis of internal documents and presentations, as well as press articles and annual reports. We chose our informants purposefully: while enterprise architects are best informed about EAM resources and capabilities, IT and business managers have a more critical perspective in their assessment of EAM's benefits and limitations. We prepared for our field entry by developing a guide for semi-structured interviews along the research framework (Fig. 1), with open questions on (1) the EAM roles (EAM-related human resources); (2) the tools (EAM-related technological resources); (3) the frameworks (EAM-related intangibles), which include elements like process models, EA reference models, and EA principles; (4) the established EAM processes (EAM capabilities); and (5) EAM's impact on the firm. As EAM is considered highly embedded in an organization, the guide contained introductory questions regarding the IS resources, capabilities, and the strategic context.

A team of 6 researchers (1 senior researcher, 2 Ph.D. students, and 3 experienced EA consultants) conducted the interviews with a total of 32 individuals from the 8 case firms over a period of 6 months (see Appendix B). Each interview was conducted by at least 2 researchers,

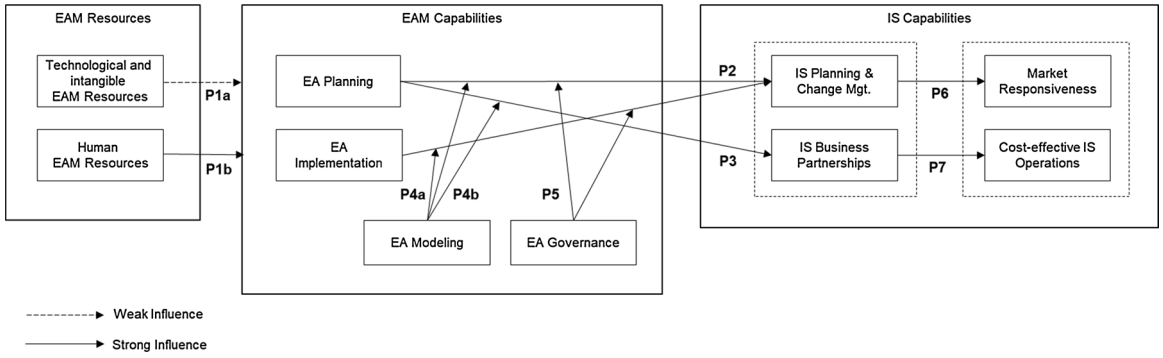

Fig. 2. Model of EAM Value Generation.

with up to 3 interviewees at a time, and the interviews lasted between 60 and 150 min. We recorded the interviews (audio files), and anonymous data presentation was assured, because sensitive information about internal processes and critical issues were discussed during the interviews. Documents were collected at the end of each interview session and used for data triangulation purposes. During the data collection phase, the interviewing researchers discussed the team's first impressions and preliminary interpretations of a case, to decide whether further actions were required to understand a case sufficiently. The case write-ups were shared with the informants and subsequently validated for approval. We also used press coverage (if available) and knowledge or documents from prior studies with the case companies to validate the findings and to avoid recall biases or distorted perceptions.

4.3. Data analysis

Our data analysis follows Miles and Huberman's (1994) approach and is structured along the ladder of analytical abstraction that Carney (1990; cited in [62], p. 92)) divides into three phases: (1) early analysis and coding, (2) within-case analysis, and (3) cross-case analysis.

In the early *analysis phase*, we summarized and packed the data by means of case write-ups to condense our empirical evidence ([59], p. 540; [63], p. 281). Each researcher who had participated in the case interviews generated a summary transcript of one case. This summary transcript was reconciled with all other case interviewers and, subsequently, with the interviewees concerning correctness and approval. The reconcilement involved different (internal and external) perspectives and several rounds for each transcript to ensure an intersubjective case description and a high degree of validity.

We performed the subsequent *coding* with the qualitative data analysis tool, atlas.ti (version 6.2). Two researchers coded the case write-ups independently, using a scheme-guided approach ([62], p. 61): We used the theoretical framework's a priori constructs (Fig. 1) to derive code categories as part of a first list of codes ([62], p. 58). This list was used as a first orientation, and both researchers changed and extended the set of codes during the process. In particular, we identified quotes describing EAM-related activities and processes to derive EAM capabilities step by step (code category, CEA). This inductive part of code building draws on Strauss & Corbin [64]: both our researchers assigned code categories to statements and created extended codes that are more precise. The coding process produced 1305 quotes based on 298 codes by Researcher 1 and 329 codes by Researcher 2, which were consolidated in the within-case analysis.

We investigated each case as a stand-alone entity before generalizing across cases: in 10 case analysis meetings, we isolated the codes per case and iteratively consolidated and refined the codes. We then built a causal network based on the codes and with the help of the case write-ups ([62], p. 155 f.). The causal network contained EAM resources, EAM capabilities, and their interplays and impacts on IS capabilities and performance. We summarized the most significant findings for each case in a narrative of the codes and causal network ([62], p. 160).

After understanding the dynamics of each case, we searched for *cross-case patterns* in a structured approach that forced investigators to go beyond their initial impressions [59]. The key step was the comparative analysis of the causal networks ([62], p. 228 f.). We first gathered all causal networks' starting nodes and ending nodes, and sorted them according to topics. We examined the causal networks' relevant parts in respect to each topic, and assigned suitable labels, such as *cost savings*. This procedure resulted in 4 topic categories to start causal chains and 8 topics to end causal chains. The author team thoroughly compared and discussed the causal streams within each of the topic categories. We used several case-ordered and concept-ordered matrix displays to support the identification of repeating patterns through replication logic. The case write-ups were available throughout the analysis process, and allowed us to fall back on the full description of the underlying dynamics. After finalizing our findings, we conducted our last analysis step – theoretical integration – by comparing our findings with the literature in a systematic review of related research.

5. Findings

Drawing on the RBT and the proposed research framework, the within-case and cross-case analyses allowed us to identify the firms' EAM resources and their capabilities, and to study how they affected the existing IS capabilities and created organizational value. In the following, we present our findings with supporting evidence from the cases and the resulting model (Fig. 2).

5.1. EAM resources

In all the cases, there was an emphasis on EAM-related intangible, technological, and human resources at the start of EAM activities (see Appendix C). The companies mostly used EAM frameworks as intangible resources and standards like TOGAF in a form customized to their specific needs. This included the adaptation of process models, reference models, or EA principles that these frameworks proposed. They also exploited technological resources – most importantly, modeling tools and repositories – to document the EA and facilitate EA-related planning and implementation processes through reports and visualizations. Surprisingly, across all the cases, there was no indication that specific EAM tools (as technological assets), or EAM frameworks (as intangible assets), had a significant impact on EAM value generation. In particular, firms with longer-term EAM experience clearly stated that specific tools and EAM frameworks were not relevant for EAM success. For instance, Bank4You explicitly avoided committing to a consistent tool, or approach, and gave domain-specific architects the freedom to choose, or develop, them by themselves. FeelGood's architects selected a very simple modeling tool and explained that their EAM success was based on their employees' understanding and acceptance,

not on predefined methods. The only case with a stronger focus on frameworks is AdminGroup. However, AdminGroup's manager responsible for EAM admitted that the firm's successful usage in this respect depended strongly on people's acceptance, and not only on the framework's maturity: *"With regard to conceptual aspects, such as our framework, we are already pretty mature, but in respect of other aspects, such as the mentality at the senior management level […] to change and apply architecture practices, we still have a long way to go"* (EAM team leader, AdminGroup).

In contrast to the low relevance of technological and intangible EAM resources, the EAM-related human resources (i.e., the EA group members' organizational position, experience, and reputations) were found to have an impact on EAM value generation. At FeelGood, the interviewees reported that the architects' proximity to the business function managers and their reputation as process experts – for example, the head of the business architects had previously been the CFO of a national organization – increased the awareness of and collaboration on EAM topics. Bank4You exhibited a similar focus on business knowledge when staffing architect positions: *"Since the role of a domain's business architect is considered fundamentally important, it was a conscious decision to only appoint internal employees to this position. To qualify, domain architects need no prior IT architectural experience, but they do require a profound knowledge of business needs and processes"* (chief architect, Bank4You). These findings are consistent with literature suggesting that EAM's success depends on enterprise architects' skills [65].

In general, while both technological and intangible EAM resources were reported not to have a significant influence on any of the four specific EAM capabilities, all of the EAM capabilities were reported to mostly depend on human EAM resources' experience, acceptance, and reputation. Thus, we conclude:

Proposition 1a. Technological and intangible EAM resources have a weak influence on the development of EAM capabilities.

Proposition 1b. Human EAM resources displaying experience with, knowledge of, and a reputation in the business domain have a strong influence on the development of EAM capabilities.

5.2. EAM capabilities

Drawing on the RBT, EAM capabilities are formed through processes in the firms that utilize EAM resources. In the cross-case analysis, we observed that the detailed activities and the performers of these processes varied, although we did find similarities regarding their general purpose and type. We also observed significant differences in how far firms develop those capabilities, which supported their grouping into (1) EA modeling, (2) EA planning, (3) EA implementation, and (4) EA governance (Table 3)

5.2.1. EA modeling capability

Although all the architects modeled or documented the EA to some degree, the EA modeling processes differed strongly between the firms with respect to their scope, granularity, maturity, and formal regulation. The more mature organizations developed sophisticated EA modeling techniques and tools that allowed comprehensive EA visualizations of all EA layers (WorldCars). Other organizations were more rudimentary and often concentrated on selected aspects in isolated EA layers, such as business processes or applications (Bank4You). In total, we could identify four core modeling-related processes (see Appendix F or case details): (1) First of all, the more mature case companies had developed the ability to systematically *analyze the information needs* of the EA stakeholders like the executives, IT managers, project managers, and the enterprise architects. They were able to provide a holistic perspective connecting different layers of the EA, such as infrastructure, applications, and business processes (TransportAll). EAs of very high complexity sometimes also require the definition of EA domains, which allow for delegation and specialization, while the organization plans the EA and develops it further (Bank4You). (2) Based on this understanding, firms develop an EA concept of what needs to be modeled, for whom, on what level of detail, and for which purpose, which is often documented by means of a comprehensive meta-model used for subsequent *tool configuration*. Reference models and EAM frameworks may also serve as a guideline and foundation during this process (WorldCars). (3) We also found that the mature organizations had developed competencies in *designing and implementing target group-specific visualizations and reports* based on their EA models (e.g., the application portfolio at WorldCars). Depending on the use cases, the format and content of these reports and visualizations varied significantly across case companies and target purposes, like strategic planning, risk analysis, cost analysis, business continuity management, and complexity management. (4) Keeping an up-to-date repository of EA-related data requires a significant effort in terms of *data collection*. The mature organizations had dedicated processes for this purpose and successfully used existing data sources by establishing interfaces with their EAM tools (BeSafe, Shop & Go).

5.2.2. EA planning capability

In addition to the EA modeling capability, we identified four processes that deal with *planning the future EA*, often involving architects, or using EA repositories in the strategic IT planning process (see Appendix D for case details): (1) Architects *contribute to strategy development* at the business and IT levels by taking on a consulting or advisory role during this process. This is applicable while developing a business strategy (AdminGroup), IT strategy (TransportAll), and application and technology strategy (WorldCars). At BeSafe and FeelGood, the architects did not participate in the strategy sessions, but they helped them by assessing the IT-related demands, or proposals, in preparatory sessions. (2) The *definition of a target architecture* is closely related to the strategy development support. For example, at TransportAll and BeSafe, the architects derived the target architecture from the business strategy, while at Bank4You this was done from a combination of strategy and as-is architecture. The architects at TransportAll translated the received business requirements into IT requirements and created a 5-year EA plan with the architectural cornerstones. At WorldCars, the distributed architectural groups defined the future state by building consensus on the application maps and the technical standards. Instead of applying a top-down strategy process, they specified the preferred applications and technologies for the group. At AdminGroup, the EAM framework was used to divide the strategy into more detailed goals. (3) Using the strategy and the target architecture as a foundation, the architects were also involved in d*eveloping an EA roadmap* to guide the migration toward the target architecture. In several firms, the development of transition plans, such as roadmaps, operationalized how to move from the as-is to the to-be state. For instance, TransportAll translated the 5-year master plan into short-term roadmaps that were used to prioritize projects, reconcile the EA development with the business unit (Tools-R-Us), or to choose how to reach the target EA from several scenarios (BeSafe). Roadmaps can also be limited to specific domains (FeelGood). (4) Though roadmap development involves the architects in defining migration paths, *project portfolio assessments* have a narrower focus on evaluation of initiatives required. Architects perform assessments from an EA perspective, at both a detailed project-specific level (Tools-R-Us, TransportAll, BeSafe, AdminGroup, and WorldCars) and an aggregated project portfolio or target architecture level (TransportAll, Bank4You, WorldCars, and FeelGood). At both levels, the goal is to ensure – before the projects start – compliance, or fit, with enterprise-wide specifications, such as the target architecture (TransportAll, Bank4You, and WorldCars), roadmaps (FeelGood), and standards (Tools-R-Us, BeSafe, AdminGroup, and WorldCars).

Table 3
EAM Capabilities.

EAM capability	Description	Manifest processes	Case Details
EA modeling	Ability to gather, structure, and document relevant parts of the EA with the necessary degree of abstraction in a goal-oriented and efficient manner, thus enabling effective EA-related communication and decision making	1 Analyzing information needs and developing effective EAM meta-models 2 Deploying EA modeling tools 3 Designing and implementing useful EA visualizations and reports 4 Collecting and capturing EA-related data	Appendix F
EA planning	Ability to plan the EA as a whole through measures that add to the standard planning process by supporting the strategy development, defining the target EA state, or the roadmap to get there, by assessing the project portfolio, and facilitating the process as a whole	1 Supporting strategy development 2 Defining target architecture 3 Developing EA roadmap 4 Assessing project portfolio	Appendix D
EA implementation	Ability to ensure that the EA develops as planned by enforcing cross-project perspectives, achieving compliance with the projects by utilizing the long-term target architecture, and supporting rollout and change processes	1 Enforcing cross-project perspective 2 Ensuring project-EA compliance 3 Supporting rollout processes 4 Facilitating change	Appendix E
EA governance	Ability to maintain a coherent set of EA-related decision rights, accountabilities, and policies aligned with architectural goals that the organization successfully enforces through monitoring and controlling activities	1 Steering 2 Monitoring and reporting 3 Escalating EA-related conflicts	Appendix G

5.2.3. EA implementation capability

Activities that address the realization of the agreed changes to the EA and, thus, implement the desired future EA, form the EA implementation capability. As changes usually occur through projects, the EA implementation capability addresses the architectural issues of the project's lifecycle (see Appendix E for case details): (1) In our cases, the architects reported that they participated in projects and *enforced a cross-project perspective*. At TransportAll and FeelGood, the architects are members of project-spanning review boards, and in this role they regularly evaluate the projects' impact. The architects at TransportAll distinguish between weekly meetings within a domain and those with a board, during which cross-domain issues are discussed. An architect at TransportAll justified these efforts as follows: *"A designer might be unaware of all of a project's impact. Consequently, the impacts are discussed in these domain-spanning board meetings. Everyone has the chance to review these impacts and is given the opportunity to identify other impacts […]. At worst, we might miss important impacts, which would mean that we'd have to deal with unintended consequences after the implementation."* At Bank4You, the architects look beyond the project and application portfolio to identify, or suggest, reusable solutions/components. FeelGood's architectural group often identifies issues and solves conflicts across projects that are not clearly the responsibility of one of the domain-specific groups, for instance, when several development projects simultaneously affect a middleware system. (2) The most prevalent EAM implementation process was *ensuring projects' compliance* with the target architecture, or the relevant architectural guidelines and standards, such as the architectural principles. Firms do so by assessing the compliance with the EA standards (Tools-R-Us, TransportAll, BeSafe, and WorldCars) and the business requirements (Bank4You, FeelGood). The ways in which compliance was reached varied and were either more or less formal: FeelGood's project teams ensure compliance through continuous collaboration with the business architects and the IT infrastructure group. At Bank4You, a board ensures that far-reaching architectural changes within projects are not implemented badly due to time-pressure or a lack of budget. At TransportAll, architectural boards conduct reviews at predefined quality gates during the project process. They evaluate technical alternatives, check specifications for consistency, and ensure that systems' rollout and migration are aligned with other projects. (3) In the later stages of the project lifecycle, EAM supports the *enterprise-wide rollout* of solutions. For instance, TransportAll's architects consider EA tool support essential for large rollouts, due to the increasing number of dependencies between applications. FeelGood's business architects supported rollout planning by identifying suitable pilot markets with the required process knowledge, or technical experience. (4) Architects *facilitate change management* by involving the right people and information to ensure controlled project execution. At WorldCars, the chief architect, together with the project lead, assigns the appropriate architects and competence centers to a project. Furthermore, architectural roles are involved in documenting and communicating business process changes (Shop & Go, TransportAll), or even in personnel training (Shop & Go). At Tools-R-Us, Shop & Go, and AdminGroup, architects began by standardizing the project documentation.

5.2.4. EA governance capability

The EA governance capability comprises activities to develop a coherent set of EA-related decision rights and accountabilities, to ensure that the development of the EA is in line with the long-term objectives, and that opportunistic decision-making does not compromise it. Moreover, installing and running a monitoring and control system allow architects and executives to analyze whether individual behavior is consistent with the architectural policies, guidelines, standards, and principles. Across our cases, we found three important governance processes (see Appendix G for case details): (1) Top management can steer EAM by participating in high-level decision-making committees, or by directly supervising EAM activities (*steering*). Through these steering processes, they can clearly communicate the goals and fundamental principles that guide EA processes, which can be used to assess individual behavior. Moreover, top management's power and influence can help drive EAM awareness and adoption [8,41]. While BeSafe, Bank4You, and FeelGood all exhibited this kind of top management steering, AdminGroup lacked steering, and WorldCars only experienced this in its IT landscape planning. (2) The second prevalent element is *monitoring and reporting* processes, which provides the relevant stakeholders with EA-related information in keeping with their specific information needs. TransportAll's EAM team monitors the implementation of the IT master plan and the development of operating costs. At FeelGood, the business domain's chief architects are the single point of contact for the CFO regarding any aggregated information about the EA. Monitoring can also be informal (Bank4You), or simply the architects' involvement in the regular reporting process (AdminGroup). (3) In cases where the enterprise architects were in *conflict* with the project managers, line managers, or other stakeholders, the more mature case companies had established efficient *escalation* processes. The committees and roles involved have the power to make quick decisions, thus limiting the processes' or projects' delay. This form of efficient decision-making can accelerate EA-related activities and support enterprise architects' work (TransportAll), which is in line with findings by Foorthuis et al. [41], who find that overly bureaucratic processes lacking efficiency have a negative impact on EAM benefits. A necessary prerequisite is that enterprise architects should have sufficient decision rights to stop activities that violate EA-related principles, policies, and

standards, or are contrary to EA-related goals. At Bank4You, the investment board only makes decisions after the enterprise architects have given their approval. At TransportAll, the architects are involved in all project-related review activities. Similar processes are at work at BeSafe: *"Nothing will be implemented without approval if it conflicts with the technical architecture, or the target architecture, and this is a great success"* (technical enterprise architect, BeSafe). In contrast, the architects at AdminGroup and Tools-R-Us struggle to obtain decision rights in the planning and implementation processes due to politically driven decision-making, or a decentralized organization.

5.3. Direct impact on IS capabilities

Using Wade and Hulland's (2004) taxonomy of IS resources and capabilities, we identified through our analysis that the aforementioned EAM capabilities had an impact on four IS capabilities: (1) IS planning and change management and (2) IS-business partnerships were directly affected, while (3) market responsiveness and (4) cost-effective IS operations were indirectly affected. At the same time, we did not identify effects on the remaining IS resources and capabilities as listed by Wade and Hulland [22].

5.3.1. The impact on IS planning and change management

A firm's IS planning and change management capability describes its ability to "plan, manage, and use appropriate technology architectures and standards" ([22], p. 114). It involves the ability to anticipate and understand future technological development, adjust the technology strategy accordingly, and manage change and growth [22,66].

At TransportAll, BeSafe, Bank4You, WorldCars, and FeelGood, we found that EAM positively affects the IS planning and change management capability as a combined result of the EA planning processes and the EA implementation processes (Appendix D, Appendix E): The informants from TransportAll, BeSafe, and WorldCars explained that the architects supported the planning for new IS and were involved in designing them, which eventually led to high-quality solutions and fewer changes. WorldCars' chief architect noted: *"Without the architects' influence, some projects would not have been successful."* EA capabilities also led to better performance during the rollout phase, because the coordination was based on thorough planning and on earlier comparisons of the as-is with the to-be models. A BeSafe enterprise architect noted: *"For the rollout planning, we can see the interfaces and consider the target architecture. We have everything in one place, where everyone can have a look, and where the data are up-to-date. Finally, we can see the whole product lifecycle and can, for instance, estimate the costs and risks."* He also described the difference in transparency: *"We can steer the rollout planning for large projects better, because we can see all the dependencies better. Transparency is essential in this context. […] Previously, we were dependent on individual knowledge."*

In addition, architects in some firms acted as facilitators of the planning process. At WorldCars, for instance, the architects mobilized the local IT managers from the different brands and plants across the world to reach a consensus on global standards. At Bank4You, the head of the architecture leads, monitors, and moderates the general IT strategy process.

At Shop & Go, IS planning and change management are facilitated by processes that implement architectural policies, principles, standards, and reference architectures so that consistent and goal-oriented change is achieved. At FeelGood, EA-related processes led to the establishing and enforcing of reference processes, standardized core applications for the whole corporation, and adequately harmonized IS configurations where possible. As a consequence, FeelGood benefitted from the better exploitation of its IS function on a global scale. Similarly, through EA planning and implementation processes, WorldCars was able to implement architectural blueprints, technology standards, and IS-related standards to reduce complexity and increase the degree of IS integration. FeelGood's and WorldCars' approaches were designed to leverage organizational growth while simultaneously not increasing the levels of architectural complexity. While FeelGood's and WorldCars' successful approaches were (to a significant extent) application-centric, the other case companies strongly emphasized infrastructure flexibility. For example, at Bank4You, the architects ran EA planning and implementation processes based on carefully developed architectural guidelines and blueprints to foster service-oriented architectures. This led to improved architectures with higher reuse of the functionality, increased levels of integration, and accelerated development initiatives. According to the chief architect, average projects were accelerated by 40 % and the costs were reduced by 50 %. This allows to exploit market opportunities more successfully through a shorter time-to-market, which eventually enabled the bank to grow faster.

Interestingly, AdminGroup struggled to exploit these benefits, because its teams did not want to exert the extra effort of creating project proposal documents, including architecture-related information. Although they had increased transparency in the project portfolio planning, the architects sometimes had problems influencing decisions: *"We see redundancy between the projects, but it's difficult to stop, or to avoid. […] Similar projects are not always started at the same time; their objectives must be achieved […], and they cannot wait"* (enterprise architect, AdminGroup). In addition, at WorldCars, adherence to the infrastructure-related standards handbook caused project delays. A deeper analysis revealed that WorldCars' infrastructure standardization initiative was too bureaucratic and inflexible, and lacked reliable update processes to account for technological advancements. On the other hand, its leaner approach to harmonizing the application landscape was a great success.

Our observations are in line with other studies' findings that view EAM as a "planning tool" ([33], p. 6), enabling the management of heterogeneous IT and the replication of IT services ([26], p. 192), as well as change management ([67], p. 3 f.). We, therefore, acknowledge an effect as expressed in this proposition:

Proposition 2. By building EA planning and implementation capabilities, firms increase their IS planning and change management capability.

5.3.2. The impact on IS-business partnerships

A firm's IS-business partnership capability describes "the processes of integration and alignment between the IS function and other functional areas or departments" ([22], p. 114). This capability relies on collaboration between the IS function and the rest of the firm, as well as business thinking in the IS planning processes. Although they differ in their labeling, various studies have shown the importance of managing IS-business relationships [48,68–71], concluding that these relationships are a source of competitive advantage, particularly through alignment with business strategy [72,73].

Our analysis showed that nearly all firms (Tools-R-Us, Shop & Go, TransportAll, BeSafe, Bank4You, and FeelGood), and specifically the more mature ones, experienced increased alignment between business and IT (Appendix D). This was mainly effected by the EA planning capability, as prior studies had confirmed [74]: at Tools-R-Us and TransportAll, the architects compared the business strategy with the portfolio of IT projects and thereby reached a higher alignment due to optimized roadmaps. Another option was to involve architects in gathering and analyzing business requirements earlier in the demand management process, particularly in firms that found a way to create continuous collaboration and communication (Shop & Go, Bank4You, FeelGood): placing domain architects in the respective business functions at Bank4You and their contribution during the planning phase, for instance, led to the IT experts focusing stronger on the business requirements and improved IT's reputation in the business units: *"The domain architects are the aligning factor between the business analysts and IT architecture; which is why they ensure business-IT alignment"* (head of

architecture, Bank4You).

We summarize these findings in the following proposition:

Proposition 3. Firms building an EA planning capability increase their IS-business partnership capability.

This proposition is in line with the literature that points out EAM's positive impact on the IS-business partnership capability as a source of improved business-IT alignment ([67], p. 3). Besides, Foorthuis et al. ([28], p. 9) find that EAM cannot effectively achieve an optimal fit between IT and business processes, other authors have consistently identified EAM as a measure to improve business-IT alignment ([75], p. 651; [30], p. 114; [33], p. 6).

5.4. The moderating role of EA modeling

Interestingly, EA modeling was only an indirect source of these benefits. Only in those cases where practitioners had made continuous use of the EA models and repositories to create targeted reports and visualizations, were they able to improve IS planning and change management (Appendix F). The chief architect at Bank4You explained that tool-based modeling can make an architect's work more efficient: *"…a huge overall EAM tool does not impact the organization … An EAM tool can help make the processes more efficient, but the tool has to follow the established processes."* We observed something similar at WorldCars. Here, the team of architects responsible for the application portfolio spent a significant amount of time developing models that support well-thought-through processes, can manage the application landscape, and serve as a foundation for decision-making. According to the team, this was key for the planning process's success. At Shop & Go, models and data on the EA are used to classify demands and analyze their impact. They also use application maps for the application portfolio's long-term development, thus resulting in a more harmonized and cost-effective IS landscape. We postulate the related effect as follows:

Proposition 4a. The EA modeling capability will interact with the EA planning capability and the EA implementation capability to increase their positive effect on the IS planning and change management capability.

Proposition 4b. The EA modeling capability will interact with the EA planning capability to increase its positive effect on the IS-business partnership capability.

It is important to stress that while modeling acts as a moderator and increases the positive effect of further EA capabilities, it appears that strict adherence to modeling rules and languages, to enterprise architecture frameworks, and the consistent application of software tools do not play a role (see Section 5.1). This finding challenges some of the fundamental assumptions of the EA discipline, which has traditionally emphasized EA modeling as a focal EAM aspect.

5.5. The moderating roles of EA governance

By carefully analyzing the cases with regard to their differences in EAM implementation and outcomes, we saw that EA governance moderates the effects of EA planning and EA implementation on IS planning and change management, as well as on IS-business partnerships (Appendix G). Across the cases, we observed that carefully designed decision rights, accountabilities, and control mechanisms help organizations unlock EAM's potential. As developing an enterprise architecture successfully very often implies that global (enterprise-related) interests are prioritized above local (project-related and departmental) interests, it is important that committees and roles supporting the global view should not only be established, but have enough power to decide in favor of the EA, or escalate decisions if there is resistance. During our analysis, it became clear that organizations implementing such EA governance have more effective planning and implementation processes. In particular, they can ensure that (1) projects that positively influence the EA are initiated and approved rather than those that serve local interests, but have a negative impact on the EA's quality, and (2) EA policies, principles, and goals are sufficiently considered while changing the EA (e.g., in projects) [41]. For example, at Bank4You, the enterprise architects are powerful enough to reject projects that do not serve the long-term development of the architecture. Bank4You could, therefore, realign its project portfolio to be more aligned with the EA goals. In contrast, the AdminGroup enterprise architects lack this power, which limits their role to that of a consultant. Consequently, the architectural development is slower and has fewer positive impacts. At WorldCars, the management learned that only through carefully designed EA governance will planning and implementation be effective. Early EAM attempts in this company, whose architects have limited or no decision rights, were significantly less successful than the later attempts when EA governance was specifically emphasized. Similarly, at FeelGood, the top management promoted the harmonization of the application landscape right from the start. The architects enjoyed significant decision-making power, which paved the way for a major transformation of the IS landscape. We thus conclude:

Proposition 5. A lack of EA governance will interact with EAM capabilities to decrease their positive effect on the IS planning and change management capability.

5.6. Indirect impact on IS capabilities

5.6.1. The impact on market responsiveness

A firm's market responsiveness comprises "both the collection of information from sources external to the firm as well as the dissemination of a firm's market intelligence across departments and the organization's response to that learning" ([22], pp. 113–114). In an IS context, market responsiveness can be understood as the ability to react to evolving market requirements and to implement a new strategy quickly by means of a new or changed IS [47,69,71].

BeSafe, Bank4You, and FeelGood experienced increased market responsiveness due to their capacity to swiftly make changes within the firm, which was the result of their improved IS planning and change management capabilities (Appendix H). The latter increased agility and fostered the realization of strategic initiatives. At FeelGood, improved planning and change management facilitated the corporation's expansion course: it would not have been possible to acquire and integrate firms so quickly if the core processes and the ERP system had not been standardized. Bank4You cooperated with a retailer to provide microcredit for electronics products at the sales points, because implementing this service – by reusing similar services – was quick and easy. Interestingly, only firms that have been engaged in EAM for several years – such as BeSafe, Bank4You, and FeelGood – reported significant improvements in *market responsiveness*. The head of the project portfolio management at Tools-R-Us reported: *"I don't think we are very flexible when it comes to implementing quick changes. Although we can execute projects very quickly, we need a lot of time to plan the initiatives. If we are forced to make changes, we need quite a long time to respond, and it requires much effort."* It seems to take time to reach the necessary degree of EAM saturation in terms of the realized EA processes, and the organizational scope before the planning and change management improvements result in higher degrees of agility; and thus, create a superior market responsiveness capability.

We conclude that the superior performance that EAM creates in the planning and implementation processes – i.e., the *IS planning and change management capability* – increases the responsiveness of the IT function as a whole. We thus formulate the following proposition:

Proposition 6. Firms using EAM to improve their IS planning, change management, and IS-business partnership capabilities are more likely to improve their market responsiveness capability.

Our findings provide a deeper understanding of EAM's effect on market responsiveness than prior research: [29], p. 77) conclude that EAM increases strategic agility, i.e., the extent to which IT improves the speed at which an organization can enter new markets, and explain that agility is derived from optimizing IT investments. Other studies show similar EAM benefits, such as "improved strategic agility" ([67], p. 3), the "ability to deal with changes" ([13], p. 208), and being "more responsive to change" ([33], p. 6).

5.6.2. The impact on cost-effective IS operations

Cost-effective IS operations denote a firm's ability "to provide efficient and cost-effective IS operations on an ongoing basis" ([22], p. 115). This ability is expected to have a positive effect on the company's performance [48,69,76] and can, in the long run, be a source of competitive advantage in terms of a cost leadership position [17,77].

Our cases provide evidence that EAM capabilities contribute to the cost-effective IS operations capability (Appendix H): according to their calculations, Bank4You and FeelGood achieved cost savings due to the harmonization of their EA, particularly of the application landscape. At Bank4You, the project costs were reduced significantly (see above), and at FeelGood, the architects estimate that their EA program has already led to direct and indirect long-term cost savings of more than 1 billion Euro. Again, this harmonization seems to be the aggregated result of the EAM capabilities as a whole: Bank4You and FeelGood reduced the amount of redundant IT systems. FeelGood consolidated its data centers and its core ERP system, while Bank4You increased IT component reuse and the extent of its standardized IT. In both cases, a standardization of the business processes accompanied the optimization of the IT portfolio. In addition, in both cases, the interviewees stated that these results would not have been possible without enterprise-wide architectural activities, particularly the EAM planning capability. An advanced EAM implementation capability also fosters cost efficiency, because inadequate decisions at the project level may induce significant adverse cost effects at the enterprise level, for instance, by introducing a new set of technologies, which increases the spectrum of skills that the company requires and the administrative overheads. We thus conclude:

Proposition 7. Firms using EAM to improve their IS planning, change management, and IS-business partnership capabilities are more likely to improve their cost-effective IS operations capability.

Comparing this proposition with related research is complicated, as many factors cited in the literature – particularly the EAM's impact on technology choices and IS/IT architecture design – are potentially related to more cost-effective IT operations. The many factors include reduced IT complexity, more effective IT resource use ([33], p. 9), increased stability, increased reusability, increased standardization, increased economies of scale ([67], p. 3), IT infrastructure cleanup, data stores consolidation ([5], p. 9), lower heterogeneity of the technologies in use, lower support costs, the dissolution of information silos ([75], p. 651), and controlling costs ([28], p. 9). We see that EAM can potentially lower costs in many ways. Instead of extending this list, our results reveal that the implementation of EAM processes have indirect cost effects and explain how these materialize. We, therefore, see a substantial contribution to EAM's issues with demonstrating cost effects, which has been discussed at length, but has to date been hard for practitioners to grasp due to a lack of transparency and assignable results.

6. Discussion

Modeling EA is a key topic of EA-related research, but our results indicate that while EA modeling is an enabler of EAM's success, this only occurs when it is linked to a number of complementary processes that ensure modeling is goal-oriented and its results (the models) are actually deployed in EA planning and implementation processes. Other than expected, sophisticated frameworks and modeling languages are not overly important for realizing EAM benefits, although some of our more successful case companies do apply them. The value of modeling lies in using the models for far-reaching EA-related decision-making to improve the decision quality. Rudimentary models are often sufficient for this purpose, provided they contain information crucial for EA planning and implementation processes. The importance of satisfying information needs is also consistent with the findings of [12], p. 15), who suggest that EAM is generally valuable for larger organizations with high information density. Along similar lines, we found that comprehensive tool support, too, is not a key facilitator of EAM's impact. This is surprising, because prior research posits the opposite [65]. While tools can certainly ease enterprise architects' work, large-scale tool implementations are not a particular characteristic of the more successful firms in our sample.

In our study, we found that EAM does not create benefits per se, but has a fairly indirect effect, because it helps further develop existing IS capabilities, which in turn have a positive impact on the way IS can contribute to a company's performance. The indirect character of EAM's effect is discussed in the RBT discourse as *resource complementarity*. Our findings identify that EAM only has an indirect impact on firm performance and reveal that EAM capabilities have a role as second-order capabilities that complement and improve existing IS capabilities. These capabilities should be considered to develop the four affected IS capabilities, namely IS planning and change management, market responsiveness, IS-business partnerships, and cost-effective IS operations.

In particular, EA planning and implementation capabilities have a positive impact on the IS planning and change management capability through the provision of transparency, harmonization of the application portfolio, reduced complexity, reference business processes, a reduction of the number of change requests, and systematic rollout support. The EA planning capability further increases the IS-business partnership capability mainly through intensified communication and coordination, as well as a structured IT demand management. The EA modeling capability was found to moderate the positive impact of the EA planning and EA implementation capabilities on the IS planning and change management capability through the provision of models as guidelines for implementation work, models as reference for development processes, and improved understanding of cost, complexity, and resource needs. The EA modeling capability further moderates the positive impact of the EA planning capability on the IS-business partnership capability through the provision of models as basis for intensified communication with business stakeholders during planning, design, and configuration. The EA governance capability moderates the positive impact of the EA planning and EA implementation capabilities on the IS planning and change management capability through the provision of decision rights, accountabilities, control mechanisms, conflict escalation, and an alignment of the project portfolio with long-term EA goals. IS planning and change management and IS-business partnership capabilities were further found to have a positive impact on (1) the market responsiveness capability through a reduction of project delays, improved exploitation of global market opportunities, and the facilitation of firm acquisitions, and on (2) the cost-effective IS operations capability through a decrease of the complexity of local infrastructure, a decrease of redundancy through a reduction of the number of applications and data centers, and a decrease of maintenance effort.

These complex findings on EAM's direct and indirect impact help explain prior studies' findings and extend them. The RBT perspective helps answer the question whether EAM is a source of competitive advantage [78], p. 6) argues that EAM can lead to competitive advantage by supporting the two basic strategies of cost leadership and differentiation. While we acknowledge that this effect exists, it is fairly indirect and realized through a complex cause-effect chain. Organizations may exploit this potential, but only in the long run and with highly developed EAM capabilities. The RBT also provides further advice on EAM's focus in different competitive situations ([22], p. 126 f.): In turbulent business environments, the impact of the IS planning,

change management, and the market responsiveness capability is found to be stronger than in stable environments. EAM programs in turbulent and dynamic environments should, therefore, focus on EAM modeling, EAM planning, and EAM implementation capabilities to utilize this leverage. However, cost-effective IS operations' capability has a stronger performance impact on stable business environments. Therefore, enterprises in stable environments should emphasize the EAM planning capability and, particularly, closeness to business in their EAM programs.

7. Conclusions

By proposing a theory-led perspective on value generation through EAM, this study adds to the research stream on EAM benefit realization. Our findings have significant theoretical and managerial implications. The discovery that EAM resources only unfold their potential when used to form EAM planning and implementation capabilities casts doubt on the established practice of initiating EAM as a modeling and documentation endeavor. Instead of collecting any potentially useful piece of information on EA, we propose that architects focus on the support of IS planning and the implementation processes by adopting an EA perspective and satisfying (the most) crucial information needs. Moreover, both managers and researchers need to rethink the roles and the designs of frameworks, tools, and models. In light of our study, most of these frameworks and tools are not flexible enough to capture the broad spectrum of EAM approaches, because they mostly follow a one-size-fits-all philosophy. We need more configurable and adaptable methodical support of EAM initiatives that considers different strategic starting points and priorities. In this context, situational approaches to EAM are promising research directions [79,80], but they need to go beyond considering only organizational or IS factors. Our study also suggests that practitioners should try to forge strong links and ties to the business departments when implementing EAM; only then can architects form the partnerships with business that are required to plan and implement a target EA. This calls for experienced enterprise architects deeply rooted in the business and with strong communication and negotiation skills, rather than young technology-savvy personnel. Decision-making rights and proximity to the business are key enablers of these human EAM resources. The classification of EAM as a secondary capability also implies that introducing EAM will only make sense when the four aforementioned IS capabilities are sufficiently mature to benefit from EAM's leveraging effect. Thus, IT organizations with low degrees of general IS capabilities should probably invest in developing these first before investing in EAM.

Our study has some limitations. While we sought to collect as much additional information from our case study firms as possible, confidentiality prevented full access to all the documents. Consequently, our study relies primarily on interview data and document analysis, which is a very efficient way of understanding complex strategic phenomena, such as EAM. Another inherent limitation relates to the complexity of the phenomena involved. While the presented results focus on the major causal relationships that the empirical data uncovered, we cannot be sure that there are no other, uncovered aspects. In particular, our study provides indications of EA-related resources' relative importance and explains some of the mechanisms through which these resources contribute to EAM's positive impact on other IS capabilities. But, we cannot claim that these types are sufficient precursors of EAM value generation. We, therefore, hope to provide a starting point for further, more specific, studies investigating the set of required resources and their specific roles in EAM value generation. Moreover, the framework for our analysis was the resource-based view, which provided us with a rich set of concepts for the analysis of the EAM value generation process. Despite the power of this approach, it might be fruitful to investigate how contextual factors, like culture [15,43], certain motivation mechanisms [81], and institutional processes [82,83], shape the building and exploitation of the aforementioned EAM capabilities.

In view of this study's contributions and limitations, we further propose that future research should use this study's findings and develop ways to measure changes in the identified EAM and IS capabilities. IS studies' rich discourse on these capabilities provides a basis for such research. It would also be fruitful to extend the scope of our study and investigate EAM's beneficial effects beyond IS capabilities [84]. For instance, it would be valuable to learn how EAM can help in building digital business capabilities in organizations embarking on a digital transformation journey [8,31,85]. We also encourage further investigations of how frameworks, methods, and tools can support value generation in particular scenarios. While EA-related modeling has long been at the center of EAM research, it is time to shift the focus to processes where EAM leverages existing IT capabilities, namely through EA planning, EA implementation, and EA governance.

CRediT authorship contribution statement

Frederik Ahlemann: Conceptualization, Methodology, Investigation, Writing - review & editing, Visualization, Supervision, Funding acquisition, Project administration. **Christine Legner:** Conceptualization, Methodology, Investigation, Writing - review & editing, Visualization, Supervision. **Johannes Lux:** Conceptualization, Methodology, Investigation, Data curation, Writing - original draft, Visualization.

Appendix A

A. Overview of Cases

	Name1 (industry)	Employees (thousand)	Sales (billions of euros)	Year EAM started	EAM starting point	Contextual challenges	Organizational anchoring of EAM	Main fields of activity
1	Shop & Go (Retail)	> 100	50 to 100	Initiative launched early in 2009	Complexity of decentralized IT/IS landscapes	Independent sales lines with diverging requirements	CIO office above all sales lines	Harmonization of IT/IS, particularly application portfolio management
2	TransportAll (Logistics)	< 25	1 to 10	Master plan since 2006; EAM since early 2009	IT/IS complexity and IT/IS costs	Decentralized process organization and decentral application development	EAM unit in the central IT department	Business process and application portfolio management, master planning, portfolio management, and project steering
3	BeSafe (Insurance)	25 to 100	10 to 50	Initiative launched in 2007/8	Complexity of IT/IS landscape and lack of transparency	Enterprise architects' resistance to interventions	Core EAM group close to the CEO	Target architecture and roadmap development and definition of IT/IS standards
4	Bank4You (Bank)	25 to 100	10 to 50	Program relaunched in 2004	Limited reuse of data and applications, the application landscape	Limited personnel	EAM unit reporting to the corporate CIO	Domain-oriented planning of target architectures and service-oriented architectures

					complexity, and the short time-to-market			
5	Admin-Group (Government)	25 to 100	> 100	Program launched in 2004	Low data quality, the lack of transparency, and limited reuse of applications	Decision-making power of architects limited and the stakeholders' political behavior	Several subunits in the central IT organization	Standardization of portfolio and development processes
6	WorldCars (Automotive)	> 100	> 100	Several initiatives; earliest in 2000; major extension in 2009	Application landscape complexity and infrastructure heterogeneity	Organization's size and complexity	Several subunits in the central IT organization	Application portfolio management, service-oriented architectures, and infrastructure standardization
7	FeelGood (Nutrition and health)	> 100	50 to 100	Program launched in 2000	Application landscape complexity and heterogeneous business processes	Need for worldwide business process standardization to leverage economies of scale and approx. 100 local IT teams	Global EAM program sponsored by the CEO	Business process standardization, introduction of packaged software (ERP), and harmonization and consolidation of infrastructure
8	Tools-R-Us (Production)	< 25	1 to 10	Initiative launched in 2009	Project interdependencies	Limited experience with EAM	EAM not yet institutionalized	Supporting a newly introduced governance regime through architectural transparency, long-term architectural roadmaps, and portfolio management

[1] Names changed to hide confidential data

Appendix B

Overview of Interviewees

Case	Interviewees	Documents
Shop & Go	• Enterprise architect with a focus on methodology and business process management • Enterprise architect with a focus on the technical perspective • CIO office head	• Company data and field notes • External publications about company development
TransportAll	• EAM team head • Chief architect with a focus on the business layer • CIO • Business process management role of one business domain	• Company data and field notes • Slides about EA program structure • Process models of key EAM processes
BeSafe	• Chief architect with a focus on the business layer • Enterprise architect with a focus on the business layer • Chief architect with a focus on the technical layer • Enterprise architect with a focus on the technical layer • EAM unit head	• Company data and field notes • EAM slides, including process models of key EAM processes • Template (spreadsheet) for process documentation • EAM overview presentation • EAM meta-model • External publications
Bank4You	• Domain architect with a focus on the business layers • Technical architect with a focus on SOA • Chief architect, leader of domain architects as head of architecture: German market	• Company data and field notes • EAM overview presentation • Internal document about standardization and industrialization paradigm • Slides about work of domain architects
AdminGroup	• Enterprise architect, EA team leader, and IT project manager • Enterprise architect with a focus on methods • Enterprise architect with a focus on the technical perspective • Manager responsible for EAM • Business process management role of one business domain • Manager, domain-specific application of EA framework, and development of governance measures	• Company data and field notes • Slides with process overviews • Filled-out datasheet about EAM • Organizational chart • IS governance documentation • EAF documentation • Strategy document of EA-related initiative
WorldCars	• Enterprise architect with a focus on application management and EA methods • Enterprise architect with a focus on business-oriented aspects of SOA • Chief architect: CTO group, leader of technical domain architects	• Company data and field notes • External publication • Governance reports • EAM overview presentation • Organizational chart
FeelGood	• Enterprise architect with a focus on the technical perspective • Enterprise architect with a focus on integrating overarching technical platforms • Enterprise architect with a focus on methods • Global CIO • Head of business process management for one business domain, former CFO • Management role for technical applications	• Company data and field notes • Slides with organizational charts • Additional information obtained through a parallel long-term study
Tools-R-Us	• Chief architect and domain-specific enterprise architect • Head of project portfolio management	Company data and field notes IT strategy presentation

Appendix C

EAM-Related Resources in the Case Organizations

EAM-related Resources	Case 1 Shop & Go	Case 2 TransportAll	Case 3 BeSafe	Case 4 Bank4You	Case 5 AdminGroup	Case 6 WorldCars	Case 7 FeelGood	Case 8 Tools-R-Us
Human resources	Several architects, mostly with a background in technology	Team of business, information, and technical architects	Several enterprise architects with in-depth business and IT expertise	Director-level chief architect steers a group of highly independent, very experienced enterprise architects with in-depth business and IT expertise	Method-oriented team of several enterprise architects in an advisory role	Large EAM team with different responsibilities related to different EA layers, often in an advisory role, with a strong focus on methods, but with limited business expertise	Wide spectrum of architecture experts active in very different IT domains on a global level with extensive business and technology expertise	One architect
Technological resources	Customized ARIS modeling tools and self-developed configuration management database (CMDB)	ARIS Tools, Enterprise Architect modeling software, WIKI, Microsoft PowerPoint, and Microsoft Visio	Planning IT management software, Adonis modeling software, and Microsoft PowerPoint	Diverse set of software tools, Adonis modeling software, Microsoft PowerPoint, and Microsoft Visio	Office applications, several dedicated EAM tools tested	Large number of different tools used across different organizational units	Ascendant software for EA documentation, Nimbus Control modeling software, and SAP solution manager as a platform for change management	No particular technological resources used
Intangible resources	Adapted ARIS methodology	No particular frameworks used and no particular modeling languages beyond those that the tools suggest	TOGAF and Zachman frameworks and EAM Tool Survey published by a university	No specific framework used	Self-developed framework based on the Zachman framework	Large number of standards and frameworks used across different organizational units	No particular intangible resources used	TOGAF and Zachman frameworks currently being evaluated and knowledge resources from Gartner and Meta Groups

Appendix D

The impact of the EA planning capability on IS planning and change management and IS-business partnerships capabilities

EA planning processes	Case 1 Shop & Go	Case 2 TransportAll	Case 3 BeSafe	Case 4 Bank4You	Case 5 AdminGroup	Case 6 WorldCars	Case 7 FeelGood	Case 8 Tools-R-Us
1. Supporting strategy development	No	Yes	Yes	Yes	Yes	Partly	Yes	No
2. Defining target architecture	Yes	Yes	Yes	Yes	No	Partly	Yes	No
3. Developing an EA roadmap	No	Yes	Yes	Yes	Partly	Partly	Yes	Yes
4. Assessing the project portfolio	No	Yes	Yes	Yes	Yes	Partly	Yes	Yes
Degree of positive impact on *IS planning and change management*	Medium Transparency established, partial harmonization of application portfolio, definition of reference architectures	High Transparency established, active involvement of architects in planning and steering processes, however, no stringent implementation of the roadmaps	High IS planning processes and portfolio-related decisions are based on solid EA-related information	High Domain-oriented approach with limited number of architects does not allow for complete coverage of the EA; however, the running of EAM processes is very influential	Low The architects are involved in the budgeting processes to assess the work program for the next two years from an architectural perspective; however, the impact is restricted due to a lack of capacity and restricted governance	Medium The EAM processes only work in parts of the EA and not equally in all the domains; there is a positive impact in areas with high adoption; the architects manage the application portfolio and define the architectural standards and blueprints to improve the integration and reduce the complexity	High The demand, portfolio, architectural planning, and roadmap processes are supported by EAM processes and practices; a highly application-centric approach; the architects develop reference business processes for core applications	Low Most planning and change management processes do not consider the EA as a whole; no structured EA planning support; however, there are domain-oriented planning and roadmap processes
Degree of positive impact on *IS-business partnerships*	Medium Improved business-IT alignment through structured IT demand management	High Joint planning with the business to improve the intensity of the communication, collaboration, and partnership; a higher degree of	High Intensified communication with the business and ongoing architectural discussion of the realization of benefits,	High IS-business partnership significantly improved through joint planning activities in those areas where EAM is implemented,	Low Discussions with business on EA-related initiatives intensified, however, no better relationships as yet, business units are quite independent	Medium Some of the EAM planning processes unfold strong positive impacts on IS-business partnerships through joint and intensive	High IT and business collaborate intensively to plan, design, and implement business processes and to support them through	Low EAM processes have not yet improved IS-business partnerships; however, the business-IT alignment is already perceived

	business-IT alignment	eventually improved business-IT alignment	consequently, better business-IT alignment		planning and coordination	applications, improved business-IT alignment	to be high in critical business domains

Appendix E

The impact of the EA implementation capability on IS planning and change management

EA implementation processes	Case 1 Shop & Go	Case 2 TransportAll	Case 3 BeSafe	Case 4 Bank4You	Case 5 AdminGroup	Case 6 WorldCars	Case 7 FeelGood	Case 8 Tools-R-Us
1. Enforcing cross-project perspective	No	Yes	Yes	Yes	No	Yes	Yes	No
2. Ensuring project-EA compliance	No	Yes	Yes	Yes	No	Yes	Yes	Partly
3. Supporting rollout processes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
4. Facilitating change	Partly	Yes	Yes	Yes	Partly	Yes	Yes	No
Degree of positive impact on *IS planning and change management*	Low To date, no real EA implementation beyond ad hoc activities and some realized documentation activities	High The architects are strongly involved in project work and take the role of advisor and reviewer of the intermediate and final results, this may speed up the development processes, because less reworking is required, the quality has also improved	High Intense involvement of the architects during the project execution, joint architectural design of the solutions with the project team, better system integration and more flexible architectures are seen as most important benefits, number of costly change requests reduced, improved rollout processes	High Intense involvement of the architects, but only in selected business domains, architects improve the general quality of the application architectures, increase reuse through service orientation, a dedicated EA board reviews the intermediate and final results	Low The architects are barely involved in project work at all. but can be consulted, cross-project interdependencies are discussed when the project is being initiated	High A large team of architects supervises projects and ensures an EA perspective, however, not all projects enjoy equal support to facilitate change, partly faster and higher quality project execution	High Dedicated global organization to manage EA-related change, there are structured processes for any kind of change or projects, very systematic rollout support	Low EA-related aspects like conformance with EA standards considered, however, no architect involvement, no support from the project team, and no holistic perspective on the EA

Appendix F

The moderating role of the EA modeling capability

EA modeling – processes	Case 1 Shop & Go	Case 2 TransportAll	Case 3 BeSafe	Case 4 Bank4You	Case 5 AdminGroup	Case 6 WorldCars	Case 7 FeelGood	Case 8 Tools-R-Us
1. Analyzing information needs	Partly	Yes	Yes	Yes	Partly	Partly	Yes	Partly
2. Deploying modeling tools	Yes	Yes	Yes	Partly	Partly	Partly	Partly	No
3. Designing visualizations and reports	Partly	Partly	Yes	Yes	Partly	Partly	Yes	No
4. Collecting EA data	Partly	Yes	Partly	Yes	Partly	Partly	Yes	No
Positive interaction effect on *IS planning and change management* and *IS-business partnerships*	Medium Limited use of models, mainly for processes within the IT organization, reference models for development projects, some to-be models for selected business processes, including applications and business objects, hardly any	High Modeling of basically all EA layers (both as-is and to-be) for seven domains and 25 subdomains, planning and analysis based on models, however, not all models have been integrated as yet, models used as a guideline for implementation	High Both as-is and target architecture are described by models (the target architecture to a lesser extent), the planning process is highly facilitated by modeling, the project work is impacted, but to a lesser degree, intensive communication based on	High Significant amount of documentation available, however, intense use of models only in respect of selected architecture domains (due to a lack of architects), models used for all EA planning and implementation activities,	Medium Modeling intended to cover all EA layers, but adoption is still quite low, the architects analyze decentralized models and look for implementation synergies based on models, models barely used during implementation work, increasing	Medium Quite fragmented EAM modeling, not all layers are affected, however, individual modeling activities are sometimes quite successful, particular focus on application portfolio, intensive interaction based on models with	Medium Modeling of almost all layers of the EA with a strong focus on business processes, reference process models are used to design and configure both business processes and the supporting applications, intensive communication with the business	Low Holistic EAM at the beginning, with modeling activities currently being initiated, only ad hoc models used during communication with business

model-based interaction with business	work, intensive communication with the business based on modeling, improved understanding of the business's costs, complexity, and resource needs	models during planning with business stakeholders	domain models used intensively for communication with business, however, not in all business domains	use of models for communication with the business	business in some layers	with regard to these design and configuration decisions	

Appendix G

The moderating role of the EA governance capability

EA governance processes	Case 1 Shop & Go	Case 2 TransportAll	Case 3 BeSafe	Case 4 Bank4You	Case 5 AdminGroup	Case 6 WorldCars	Case 7 FeelGood	Case 8 Tools-R-Us
1. Steering	Partly	Yes	Yes	Yes	Partly	No	Yes	No
2. Monitoring and reporting	No	Yes	Yes	Yes	Partly	Partly	Yes	No
3. Escalating EA-related conflicts	No	Yes	Partly	Yes	No	Partly	Yes	No
Negative interaction effect on *IS planning and change management*	High EA-related goals, principles, and policies are not sufficiently enforced; no decision rights for enterprise architects; IT executives understand relevance of EAM, but have not yet formulated a clear framework	Low Full support from the CIO, comprehensive control processes, architecture review board for escalation processes, and comprehensive reporting organized by the architects, however, reporting does not cover holistic EAM benefits	Low Architects are allowed to halt project activities, when required, however, there are limitations to escalation, monitoring and reporting still immature, but under development	Low No effective governance in all the business domains due to limited number of architects, however, when installed, the EA governance is very effective	High Mostly high-level and very abstract frame setting by executives with limited power, which does not lead to working governance mechanisms, very high degree of local autonomy, no real power for enterprise architects, some basic reporting procedures set up	Medium Some EAM initiatives have implemented a strong governance regime (e.g., application portfolio management), some are weak in this regard (e.g., standardization of infrastructure)	Low Governance regime with very company-specific roles and committees, more complex, due to the global organization, key concern: balancing local and global interests	High EA governance in its infancy, ideas available, but very few working governance mechanisms

Appendix H

The indirect effect on market responsiveness and cost-effective IS operations capabilities

EA/IS capabilities	Case 1 Shop & Go	Case 2 TransportAll	Case 3 BeSafe	Case 4 Bank4You	Case 5 AdminGroup	Case 6 WorldCars	Case 7 FeelGood	Case 8 Tools-R-Us
Degree of EAM-enabled IS planning & change management	Low	High	High	High	Low	Medium	High	Low/ Medium
Degree of EAM-enabled IS-business partnerships	Medium	High	High	High	Low	Medium	High	Low
Positive impact on market responsiveness	Low Focus of future EAM development	Low Increase in agility not yet measurable	Medium Responsiveness increased, e.g., through fewer project delays, further effects expected in the future, because some EA processes have only recently been introduced	High Significant increase in speed and flexibility, chief enterprise architect reports on projects that have accelerated by 40 %, successful exploitation of new market opportunities	Low No impact yet	Low Flexibility has not yet increased	High Individual local demands may be processed more slowly than previously, however, rollouts and global process improvements accelerated, global organization better at responding to market opportunities, improved support for global expansion strategy, easier acquisition of firms	Low No impact yet

Positive impact on cost-effective IS operations capability	Medium Cost reduction through successful standardization and harmonization activities, however, the potential has not yet been fully realized	High Costs are reduced and better controlled through holistic architecture planning and adherence to architectural principles, however, no clarity on the effect's strength	High Reduction in costs by avoiding redundancies and locally created complexity	High Decreasing number of applications and decreased maintenance effort	Low Limited impact in some selected architectural domains due to the realization of synergies and standardization	Medium Application portfolio and infrastructure complexity reduced significantly, reduced overall costs, however, the infrastructure layer has not yet been significantly affected	High Standardization efforts mean a significant investment, but reduce the architecture's complexity significantly (fewer applications), fewer data centers	Low No impact yet

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