TECHNISCHE UNIVERSITÄT MÜNCHEN

TUM School of Computation, Information and Technology

Application and Development of Business Capability Maps in Horizontal Collaborations

Fatih Yılmaz

Vollständiger Abdruck der von der TUM School of Computation, Information and Technology der Technischen Universität München zur Erlangung des akademischen Grades eines

Doktors der Naturwissenschaften (Dr. rer. nat.)

genehmigten Dissertation.

Vorsitz:		Prof. Dr. Stefanie Rinderle-Ma
Prüfer der Dissertation:	1.	Prof. Dr. Florian Matthes
	2.	Prof. Dr. Martin Bichler

Die Dissertation wurde am 09.01.2023 bei der Technischen Universität München eingereicht und durch die TUM School of Computation, Information and Technology am 03.07.2023 angenommen.

Zusammenfassung

Problemstellung: Seit Jahrzehnten kooperieren Unternehmen, um die gegenseitigen Schwächen auszugleichen und sich somit Vorteile zu verschaffen. Diese Zusammenarbeit kann dazu führen, dass sich sogar konkurrierende Unternehmen zusammenschließen, um gemeinsame Ziele zu verfolgen, wovon die beteiligten Unternehmen profitieren. Diese reichen von der Kostenoptimierung bis hin zur Entwicklung neuer Produkte und Dienstleistungen. Um die damit verbundenen gemeinsamen Projekte erfolgreich zu realisieren, müssen die beteiligten Unternehmen nicht nur ihre Geschäftsprozesse, sondern auch die IT-Komponenten aufeinander abstimmen. Die Tatsache, dass Geschäftsprozesse heutzutage mit der Anwendungs- und Infrastrukturlandschaft des Unternehmens verknüpft sind, stellt für jede kooperierende Organisation eine beträchtliche und weitreichende Herausforderung dar. Viele Praktiker haben diese Problematik bei der Zusammenarbeit mit Unternehmen erkannt. Folglich benötigen Unternehmen für die Steuerung und Koordinierung von Kooperationen unterstützende Maßnahmen. Es gibt jedoch nur wenige Forschungsarbeiten zu diesem Thema. Aus diesem Grund wird im Rahmen dieser Dissertation die Eignung der Business Capability Map (BCM) zur Unterstützung horizontaler Kooperationen untersucht.

Forschungsdesign: Dieses Forschungsvorhaben beruht auf Beobachtungen in der Praxis und den dadurch aufgedeckten Forschungslücken. Aus jeder Forschungslücke wurde eine Forschungsfrage abgeleitet, die durch die Anwendung mehrerer Forschungsmethoden beantwortet wurde. Die erste Frage bezieht sich auf den Beweggrund der Unternehmensarchitekten für die unternehmensübergreifende Zusammenarbeit. Die zweite und dritte Forschungsfrage beschäftigt sich mit der Anwendung und Entwicklung der BCM in horizontalen Kooperationen. Für jede Forschungsfrage wurde zunächst eine strukturierte Literaturrecherche durchgeführt, um den Wissensstand auf dem Forschungsgebiet zu ermitteln. Die Forschungsfragen wurden anschließend mittels mehrerer Fallstudien in verschiedenen interorganisationalen Enterprise Architecture Management (EAM)-Initiativen beantwortet. Im Rahmen der explorativen Forschung wurde durch semistrukturierte Interviews und Umfragen die Ansichten und Erfahrungen von EA-Experten eingehend untersucht.

Ergebnisse: Die Ergebnisse der Veröffentlichungen ermöglichen es, sämtliche in dieser Dissertation festgelegten Forschungsfragen zu beantworten. Es wurde festgestellt, dass abhängig von der Motivation und Zielen der Zusammenarbeit, die Kooperationsformen in den Fallstudien variieren. Die Untersuchung der Anwendung der BCM ergab eine Liste von zwölf Anwendungsfällen, die Unternehmen bei der Bewältigung typischer Herausforderungen in horizontalen Kooperationen helfen können. Verwandte Anwendungsfälle wurden gruppiert und den Kollaborationsformen und -zielen zugeordnet. Darüber hinaus wird ein Referenzprozess für die Entwicklung einer unternehmensübergreifenden BCM vorgestellt. Die Ergebnisse wurden iterativ auf Basis von Erkenntnissen aus Fallstudien entwickelt, an denen 14 internationale Unternehmen aus vier Branchen beteiligt waren.

Beitrag: Die Forschungsergebnisse tragen in dreierlei Hinsicht zum Wissensstand über unternehmensübergreifendes EAM bei: (1) Die Auflistung von Motivationen, Zielen und erhofften

Vorteilen der Zusammenarbeit zwischen Unternehmen im Bereich EAM führt zu einer Erweiterung der Literatur in diesem Forschungsbereich. (2) Die identifizierten Anwendungsfälle verschaffen Forschern und Praktikern eine Übersicht der möglichen Anwendungsszenarien der BCM im unternehmensübergreifenden Kontext. Durch die Zuordnung der Anwendungsfälle zu Kollaborationsformen mit unterschiedlichen Zielen können Unternehmen passend zu ihrem Kollaborationsvorhaben und -eigenschaften relevante Anwendungsfälle ableiten. (3) Die EAM Literatur wird durch die Vorstellung des Referenzprozesses für die unternehmensübergreifende Modellierung der BCM erweitert.

Limitationen: Diese Dissertation und die ihr zugrundeliegenden Veröffentlichungen unterliegen mehreren Limitationen. Inhaltlich sind die vorgestellten Ergebnisse ausschließlich für horizontale Kooperationen gültig. Weitere potenzielle Limitationen betreffen die interne und externe Validität sowie die Konstrukt- und Schlussfolgerungsvalidität. Um diese Forschungsrisiken zu minimieren, wurden geeignete Gegenmaßnahmen ergriffen, die in jeder Veröffentlichung ausführlich beschrieben werden.

Ausblick: Diese Dissertation kann als Grundlage für mehrere Folgearbeiten und Studien dienen. Die Ergebnisse dieser Studie können von Forschern und Praktikern aufgegriffen werden, um geeignete Visualisierungen und toolgestützte Lösungen zu entwickeln, die den Einsatz der BCM im interorganisationalen Kontext zu erleichtern. Diese Studie trägt zum Verständnis von EAM in horizontalen Kooperationen bei. Sie ebnet jedoch auch den Weg für weitere Forschungen in vertikalen Kooperationen. Der Modellierungsprozess von Business Capabilities bietet Anreize für weitere Studien über die Abhängigkeit und den Einfluss der Struktur und Größe des Entwicklungsteams auf die Konsensbildung. Darüber hinaus können zusätzliche Fallstudien die Robustheit der Ergebnisse dieser Studie kontinuierlich verbessern und untermauern.

Abstract

Problem Statement: For decades, organizations throughout the industry have been collaborating with each other in order to compensate for deficiencies and create mutual benefits. This mutualism may lead companies, regardless of being competitors, to join forces to achieve common goals in a manner that benefits all the organizations involved. These benefits range from cost optimization to the development of new products and services. To achieve these goals and for any joint project to be successful, the companies involved need to align not only a number of business processes but also IT components. The fact that business processes nowadays are linked to the company's application and infrastructure landscape represents an extensive and considerable challenge for any collaborating organization. Many practitioners have recognized this challenge during collaborations with organizations. Consequently, enterprises need supportive measures to manage and coordinate collaborations. However, limited research exists on the subject. For this reason, in this doctoral thesis we investigate the suitability of the Business Capability Map (BCM) to support horizontal collaborations.

Research Design: This research endeavor emerges from observations in practice and concomitantly uncovered research gaps. We derived a research question from each research gap which we answered by applying multiple research methods. The first question is relates to the motivation of enterprise architects to collaborate. The second and third research questions are concerned with the application and development of the BCM in horizontal collaborations. We first conducted a structured literature review for each research question to identify the state of knowledge in the research field. The research questions were subsequently answered based on the findings from multiple-case studies across several interorganizational Enterprise Architecture Management (EAM) initiatives. As part of exploratory research, we identified in-depth perceptions and experiences of experts by conducting semi-structured interviews and surveys.

Results: The embedded publications provide multiple results that allow us to answer the predefined research questions in this dissertation. We discovered that depending on the motivation and goals of the collaboration, the forms of cooperation varied in the case studies. The investigation regarding the application of the BCM revealed a list of 12 use cases that can help organizations to address typical challenges occurring in horizontal collaborations. We clustered related use cases into groups and assigned them to voluntary and organized collaboration with the cooperation's respective goals. In addition, a reference process for developing an interorganizational BCM is presented. The results were developed iteratively based on findings from case studies involving 14 international companies from four industries.

Contribution: The research findings contribute to the body of knowledge of interorganizational EAM in three ways: (1) The list of motivations, goals, and expected benefits of collaboration between companies in the field of EAM leads to the expansion of literature in this research field. (2) The variety of use cases allows researchers and practitioners in the field to have a clearer view of potential application scenarios for the BCM. By assigning the use cases to collaboration forms with varying goals, organizations are able to find and select relevant use cases depending on their collaboration needs and characteristics. (3) The presented reference

process for interorganizational BCM modeling contributes to the literature on business capability modeling.

Study Limitations: This dissertation and the publications on which it is based on are subject to several limitations. From a content point of view, the results presented are only valid for horizontal collaborations. Therefore, generalizability is limited to the horizontal collaboration direction only. Other potential limitations include internal, external, construct, and conclusion validity. In order to minimize these research threats, appropriate countermeasures were taken and described in detail in each publication.

Future Research: This doctoral thesis could serve as a basis for several follow-up theses and studies. The results of this study provide a solid foundation for researchers and practitioners to develop appropriate visualizations and tool-based solutions to facilitate the use of BCMs in an interorganizational context. This study contributes to the understanding of EAM in horizontal collaborations. Nevertheless, it also opens the door to further research on vertical collaborations. The modeling process of business capabilities gives incentives for additional studies on the dependence and impact of the structure and size of the development team on consensus building. Ultimately, additional case studies can continuously improve the robustness and bolster the results of this study.

Acknowledgment

This thesis results from my research as a doctoral candidate at the Chair for Software Engineering for Business Information System (sebis) at the Technical University of Munich (TUM). At this point, I would like to take the opportunity to thank all the people who made this work possible.

First and foremost, I would like to thank my supervisor Prof. Dr. Florian Matthes, for offering me the opportunity to conduct this research. He supported me with constant feedback and guidance throughout the last years. I greatly appreciate the trust he has placed in me. Further, I would also like to thank Prof. Dr. Martin Bichler for being the second supervisor of my dissertation.

I would also like to thank my colleagues in alphabetical order for their mutual support both in research and in the organization of lectures: Gloria Bondel, Ulrich Gallersdörfer, Gonzalo Munilla Garrido, Ingo Glaser, Dr. Dominik Huth, Dr. Martin Kleehaus, Nektarios Machner, Dr. Felix Michel, Sascha Nägele, Pascal Maurice Philipp, Phillip Schneider, and Ömer Uludağ. Of course, I would also like to thank Aline Schmid and Jian Kong for their support in administrative issues at the chair. However, my special thanks go to my friend and mentor, Dr. Pouya Aleatrati Khosroshahi, who always provided me with his advice. Additionally, I would like to thank my students that supported me during my journey.

This work was initiated by the Institut für Rundfunktechnik. Therefore I would like to thank Prof. Dr. Rainer Schäfer and Dr. Markus Ludwig. Through their networking with national and international companies from the media environment, they gave me access to numerous research partners. I would also like to thank Prof. Dr. Dr. Birgit Spanner-Ulmer. She made it possible for me to subsequently work as an enterprise architect at the Bayerischer Rundfunk and continue my research. This was not only a welcome change but also enabled me to develop both professionally and personally. I would like to thank Thorsten Oberbekmann and Christian Hartmann for their understanding from the very beginning. I would also like to thank Peter Altendorf, Daniel Rohrmoser, and Sabina Elser for the great teamwork.

Last but not least, I would like to thank my parents, Mehmet Yılmaz, Hatice Yılmaz, and my sister Fatma Yılmaz for their continuous and unconditional support. They have always supported me not only during the time of my research but throughout my whole life.

Garching b. München, 09.01.2023

Fatih Yılmaz

Table of Contents

List of Figures

List of Tables

Part A

CHAPTER 1

Introduction

This chapter introduces and motivates the following dissertation. For this purpose, the problem to be addressed is first described (see Section 1.1). The research gaps derived from the stated problem are presented next (see Section 1.2). The last section of this chapter outlines the structure of the thesis (see Section 1.3).

1.1. Problem Statement

Innovation is a key driver of global economic growth and social development [Dru06]. Often entrepreneurs enter the market with innovative products and compete with existing companies [WT99, JI94]. As a result, many companies are moving away from the conventional conception of competition to coevolution to create new opportunities [Moo96]. This leads to companies increasingly collaborating with, but also depending on, their suppliers, customers, and competitors [HS06, Bar04, CP04]. Collaboration is often driven by the exploitation and development of resources and is subject to a specific interaction strategy [TW89].

In almost all industries, we can find collaboration in the form of a buyer-seller relationship [TFC96]. Often, these are cooperations between suppliers and manufacturers [Bar04]. For example, automotive manufacturers have a close relationship with their suppliers. The relationship with the customer represents another typical form of cooperation, which is located at the end of the value chain. Further examples can be found in the aviation industry. Aircraft manufacturers are in a close buyer-seller relationship with airlines. These two types of cooperation are examples of vertical cooperation. In contrast to vertical collaboration, horizontal collaboration describes the cooperation of companies from the same industry, which may also be competitors [Bar04]. These companies cooperate in certain areas of their value chain in order to achieve mutual benefits [SS02]. For example, two pharmaceutical companies might collaborate on researching and

producing a new vaccine. However, such collaboration requires intensive communication and coordination on both sides.

A number of obstacles complicate collaborative projects. One of the main challenges in any collaboration is reliable information sharing, including identification, creation, and use of relevant information at the right time [MR08, MSS+13, MGS05, WTS07]. Moreover, the information should be accessible not only to certain members of the network but to each and every member [MP14, MR08]. Once the needed information has been identified and made accessible, a common understanding of the information must be created [AP10]. However, this is barely possible due to the involvement of several companies using different business terms and abbreviations. This communication effort increases as the number of collaborating organizations grow. For this reason, we are convinced that communication should be supported by a suitable tool.

Companies often do not disclose business processes because they contain corporate secrets, which the company hopes will give it a competitive edge [RBM04]. This makes it difficult to achieve the necessary transparency between companies [AP10, PK08]. In addition, business processes often change in order to adapt to customer requirements and technological developments [AEE+09] and are hard to duplicate because they are tailored to the nature of each company [Trk10, MMS06]. Thus, business processes are only suitable to a limited extent as a supporting tool for cross-company communication.

Not only do the business processes of the two companies need to be aligned, but also the application and IT infrastructure landscapes [DS14]. Each partner in the network has a different infrastructure which complicates the implementation of joint solutions in the networked organization [LZP+10]. This increases the complexity of the coordination between the companies.

Overall, collaboration often requires coordination not only at the business level but also at the underlying IT levels of the enterprise [DS14, LZP+10, MMS06]. This draws our attention to the Enterprise Architecture (EA) discipline, which considers these layers holistically [Buc11].

So far, scholars have paid little attention to EA in a multi-organizational context. According to Kotusev's structured literature review on previous work in the field of EA, interorganizaitonal EA was a topic of only 0.9% of conducted research [Kot17]. The first attempts towards interorganizational EA were made by Goel et al. As a result of their research, they point to the lack of adequate cross-organizational EA models [GSG09].

The outcome of Goel et al.'s research has strengthened our hypothesis that a jointly developed and used model can foster communication in an enterprise network. In this dissertation, we investigate the suitability of the Business Capability Map (BCM), which is a widely used EA artifact representing an organization's functional capabilities [FMSN11]. We found final confirmation for this research endeavor in Zdravkovic et al.'s publication on capabilities in EA: "The capability [is seen] as a means of an easier integration with other companies and partners, by being able to show abilities by distinct functionalities or through a [business] capability map" [ZSG18].

These problem areas point to research gaps in the field of horizontal cooperation from an EA perspective. In the following section, we present these research gaps and research questions that emerged from observations in practice.

1.2. Research Questions

The overarching objective of this thesis is to improve the understanding of interorganizational EA activities in horizontal collaborations by investigating the application and development of a shared BCM. Following this objective, we thoroughly describe the gaps identified in the literature and observations we could make in practice. The research gaps eventually lead to three related research questions that are answered in this dissertation.

As in any other expert field, there are scientific and practical conferences for Enterprise Architecture Management (EAM) (e.g. EAMKON). Enterprise architects attend such events to benefit from presentations by other architects, to give presentations themselves, and to network. These conferences show us that experts in the field of EAM are generally receptive to an exchange of information. We were able to observe this willingness among enterprise architects from various media companies. They even maintained regular exchanges outside of conferences. However, the motivations for this exchange between enterprise architects have not yet been addressed in the literature.

Research gap:
The existing literature on interorganizational EA is still limited. It does not address the reason and motivation for enterprise architects to collaborate. There is no analysis of the objectives and benefits of exchange among enterprise architects from different organizations.

The literature reveals extensive research on interorganizational business process management [BDE+13, MSLH02] and the interoperability of Information Technology (IT) systems [BBF+19, DS19]. Compared to business or IT-related fields, little research is conducted regarding collaboration across individual organizations in the field of EA [Kot17]. However, organizations have recognized that neither their business processes nor their IT components are isolated from their business partners. Companies are increasingly intertwined and linked with cooperating organizations [DS14].

While literature describes the challenges and obstacles of collaborating horizontally [AP10, PK08, MP14], there is a lack of academic research on the motivation of enterprise architects to interact with one another and share their knowledge. In order to fill this gap, we conducted a multiple-case study that identifies the driving forces, objectives, and expected benefits for enterprise architects of horizontally cooperating companies to work together. Accordingly, we articulate the following research question:

Research Question 1

RQ 1: What is the motivation for enterprise architects from different organizations to work together?

During interviews we conducted with EA experts on the topic of digitization in the media industry, we were able to identify a number of challenges faced by the companies involved. One challenge that stood out from the list is the isolated processing and lack of collaboration on similar topics and tasks with other media companies. In quest of the root cause of this challenge, we came across lack of communication driven by the use of different vocabulary to

describe technical terms. This study is described in detail in the additional Publication (P)5 (see Appendix B). To address this and other challenges in horizontal collaboration, we investigate the suitability of BCM in this dissertation.

Research gap:
Business capabilities and BCMs are established EA artifacts in practice. Consequently, their use in single organizations has already been sufficiently studied. However, there is no existing research on use cases that go beyond corporate boundaries, including horizontal collaborations.

Both widely used in practice and extensively studied in academia, the BCM is an indispensable tool in EAM [AKHV+18, UR11, OSP17]. There is hardly an EAM tool on the market that does not model and evaluate business capabilities [GLGS21]. As an fundamental artifact in EA practice, it gives a comprehensive perspective of the organization, including its main business capabilities [FMSN11]. The BCM is used to interact with various stakeholders and is frequently utilized as a starting point for the management to analyze the delivery of capabilities [ZSG18]. Targeted visualizations are built by mapping business and IT components to the corresponding business capability [UR11]. This allows the identification of dependencies and formulation of suggestions for further action [US04]. In horizontal collaboration, organizations from the same industry cooperate in the same parts of their value chain [SS02]. Therefore, the development and use of a joint BCM seem to be evident since the collaborating companies have similar business capabilities. By visualizing the capabilities as a BCM, the companies can use it as a communication tool within the collaboration and address further challenges we identified during our studies [AP10, PK08, MP14]. Due to the fact that BCMs were initially designed for usage within a single organization, there is limited research in the field of interorganizational EAM.

Consequently, there is also no research providing an overview of the possible use cases of interorganizational BCM in horizontally cooperating companies. To fill this gap, we conducted a survey and multiple-case studies in different industries to identify the use cases. We also map the use cases to collaboration challenges identified by structured literature reviews and confirmed by expert interviews. Since multiple forms of horizontal collaboration exist, we distinguish and cluster the use cases accordingly. The results of these research steps answer the following research question:

Research Question 2

RQ 2: What are the use cases for a business capability map in horizontal interorganizational EA collaboration?

We noticed that when the enterprise architects collaborated to develop the BCM, they could not benefit from any existing framework that described how to proceed.

Research gap:
There are no studies describing the process of defining business capabilities and modeling BCM in an interorganizational setup. The overall structure, including the active roles, needed information, and meeting setup, has not been researched yet.

There is an increase in studies on how one single organization may identify and define its business capabilities [BBH07, ZSHG13, EGH+15]. However, the process of generating business capabili-

ties and modeling the associated BCM involving numerous organizations is not yet explored and may differ significantly from the development process in a single company. The process would not only include the successive steps of activities but also die involved roles and necessary information to define business capabilities. Due to the move to collaborative business ecosystems and interorganizational partnerships, this needs to be investigated.

By conducting a systematic literature review, relevant work was identified to provide an understanding of the development process in a single organization. Based on this, semi-structured interviews are conducted following the guidelines for multiple-case study [RH09, Yin15]. We defined and evaluated the process by observing the development process and conducting interviews with experts involved in interorganizational business capability modeling initiatives. The result is compared to approaches of modeling business capabilities in single organizations in order to identify similarities as well as differences. These steps allowed us to answer the following research question:

Research Question 3

RQ 3: How should horizontally cooperating organizations proceed in jointly modeling a business capability map?

1.3. Structure of the Thesis

This dissertation covers three research questions, which are answered by four key publications. The structure of this cumulative thesis consists of three parts (see Figure 1.1).

Part A consists of three chapters. The first chapter provides an introduction to the dissertation by motivating the research in the field of interorganizational EAM and describing a problem statement (see Section 1.1). Further, it comprises the three research questions of the thesis (see Section 1.2) and describes the overall structure of the thesis (see Section 1.3). The second chapter of part A provides theoretical background information on EA and EAM (see Section 2.1), business capabilities (see Section 2.2), and interorganizational collaboration (see Section 2.3). In the last chapter of part A, the research design (see Chapter 3) is presented with the underlying research strategy (see Section 3.1) and the used research methods used in the publications (see Section 3.2).

Part B presents the four peer-reviewed publications this dissertation is based on. Each paper is described by a fact sheet and the paper's abstract. The sequence of the paper follows the defined research questions. The full text of each publication is added to the appendix (see Appendix A). The first paper deals with the motivation of enterprise architects to work in an interorganizational environment. Further, it brings the aim and expected benefits of collaborations with other enterprise architects to light (see P1). The following two papers focus on the application of BCMs in horizontal collaborations. While one of the publications uncovers use cases and maps them to recurring challenges in collaborations (see P2), classifies the second paper use cases into different collaboration forms and their goals (see P3). The fourth paper presents a reference

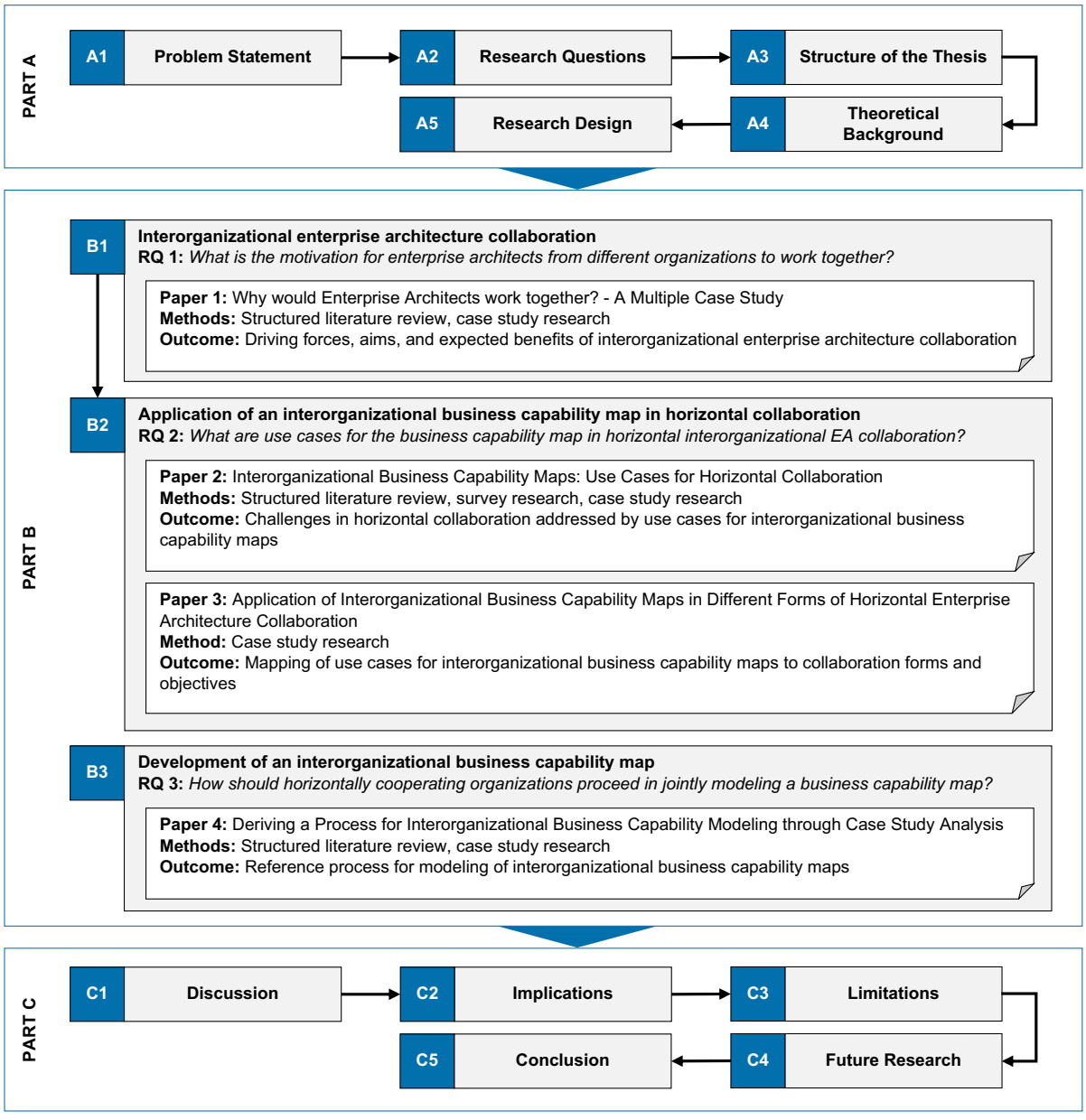

Figure 1.1.: Structure of the doctoral thesis

process for defining and visualizing business capabilities in an interorganizational context (see P4).

Part C concludes the thesis in five chapters. In the first two chapters of this part, we discuss the results of the publications by contrasting them with the research questions (see Chapter 4) and present the implications of our research (see Chapter 5). Contributions for research (see Section 5.1) as well as contributions for practice (see Section 5.2) are presented. The next chapter highlights the limitations of the study (see Chapter 6). Ideas for future research are presented in the subsequent chapter (see Chapter 7). Finally, the last chapter concludes the thesis by summarizing the results (see Chapter 8).

The subsequent paragraphs briefly describe the four publications embedded in this thesis which are summarized in Table 1.1. For each publication, we present its respective research problem, research design, and main contribution.

Table 1.1.: Overview of embedded publications

RQ	No.	Title	Authors	Outlet	Type
RQ1	P1	Why would Enterprise Architects work together? - A Multiple Case Study	• F. Yılmaz • D. Akdemir • F. Matthes	AMCIS 2020* (CORE: **A**)	Conference
RQ2	P2	Interorganizational Business Capability Maps: Use Cases for Horizontal Collaboration	• F. Yılmaz • O. Schmidt • F. Matthes	AMCIS 2021* (CORE: **A**)	Conference
	P3	Application of Interorganizational Business Capability Maps in Different Forms of Horizontal Enterprise Architecture Collaboration	• F. Yılmaz • F. Matthes	CBI 2021* (CORE: **NR**)	Conference
RQ3	P4	Deriving a Process for Interorganizational Business Capability Modeling through Case Study Analysis	• F. Yılmaz • J. Feldmeier • F. Matthes	ICEIS 2021* (CORE: **C**)	Conference

Legend:
AMCIS: Americas Conference on Information Systems
CBI: International Conference on Business Informatics
ICEIS: International Conference on Enterprise Information Systems
CORE: Computing Research & Education Ranking
NR: Not ranked
*All publications are peer-reviewed and published

P1: Why would Enterprise Architects work together? - A Multiple Case Study

Motivated by the ongoing change in the business environment and customer needs, organizations are encouraged to cooperate with other companies [HS06, Bar04, CP04]. However, the willing-

ness to cooperate with other organizations is often based on the company's aims and the expected benefits of this cooperation [SS02, EE96]. The question about the driving factors and expected benefits for collaboration arises also when it comes to a collaboration on EA level. Although the collaboration of companies in the EA domain is increasing and the research field of cross-company EA is thus coming to the fore, few research results exist on this topic [Kot17]. Even the publications identified through a structured literature review leave this question unanswered. In this paper, we conducted a multiple-case study including 13 semi-structured interviewees from 11 organizations involved in two cross-organizational EA initiatives. As a result, we identified eight different objectives and eight expected benefits for enterprise architects of being involved in interorganizational EA initiatives. However, the results heavily depend on the cooperation form. "Working groups" of closely cooperating organizations are interested in identifying of IT cost-saving opportunities. In contrast, a "community of practice" is keen to exchange knowledge and experiences on topics of common interest. These findings allow us to understand the motivation of enterprise architects to collaborate in different collaboration forms. In P3, we seize on the results of this paper to group the use cases of an interorganizational BCM according to objectives and collaboration form.

P2: Interorganizational Business Capability Maps: Use Cases for Horizontal Collaboration

Business capabilities provide a holistic view of the organization's key competencies [OSP17]. The visualization in the form of a BCM allows enterprise architects to align business and IT components by mapping them to the respective business capabilities [AKHV$^+$18, ZSHG13]. The possible use cases of a BCM in single organizations have already been extensively researched (cf. [BFM18]). One specific use, for instance, is identifying and highlighting complexities in the application landscape [AKHV$^+$18]. Even though there is an increasing interest in research and practice, the BCM was not evaluated as a collaborative tool in the field of EAM yet. Especially in horizontal collaborations where organizations follow the exact value chain modeling and using a joint BCM may offer advantages. First, we identified recurring challenges in interorganizational collaborations to evaluate if the use of a BCM can address them. Second, we present a list of use cases for the BCM in horizontal collaborations. As a result, we could identify nine confirmed and ten potential use cases classified into five categories of use cases. Finally, we could show that the identified challenges in the first step can be reduced by using a BCM in an interorganizational context. The presented stages were performed by applying mixed research methods. The challenges are identified by conducting a structured literature review and confirmed by expert interviews. The categories result from an online survey among enterprise architects, whereas the actual use cases were identified by conducting semi-structured interviews with EA experts as part of a multiple-case study. As one key finding of this paper, we have noticed that the implemented use cases strongly depend on the form and goal of the collaboration. This would be, at the same time, the motivation for the follow-up research we presented in P3.

P3: Application of Interorganizational Business Capability Maps in Different Forms of Horizontal Enterprise Architecture Collaboration

In P2, we have already investigated the use of BCMs in horizontal collaborations and showed that it is a suitable tool to address typical challenges in collaborations. Organizations may utilize a BCM as a communication tool within a cooperation project to discuss the relevant capabili-

ties. The collaboration strategy, however, is based on the organization's aim and motivation to collaborate [SS02]. Therefore, each collaboration follows a specific form depending on the collaboration structure and setup [ZP97, LEG99, Kil11]. According to the collaboration form and collaboration goals, some use cases are more relevant than others. However, existing literature does not examine the link between collaboration aims and BCM use cases in various forms of cooperation. In our previous research, we have always distinguished between the collaboration forms "working group" and "community of practice". Each case study can be assigned to one of the two forms based on the characteristics of the collaboration. Furthermore, the participants in the respective collaboration forms also pursue different goals, which we have already identified and presented in P1. In P3, we take up these goals and assign them to the use cases, which we presented in P2. In this way, we create an overview of the relevant use cases for the respective collaboration form. As a result we show ten relevant use cases for "working groups" and four applicable use cases for "communities of practice". Furthermore, by conducting an additional case study, we were able to further extend the research findings from P2. By investigating the possible applications of the BCM in a "working group" from the healthcare sector, we were able to add three more use cases to the list.

P4: Deriving a Process for Interorganizational Business Capability Modeling through Case Study Analysis

There has been an increase in studies on how single companies may identify and create their business capabilities and model a BCM [ZSHG13, BBH07, EGH+15]. But despite the move from an isolated way of working to cooperating business ecosystems, the process of establishing and modeling business capabilities involving multiple companies is hardly ever researched and may differ significantly from the one in a single organization. Inspired by the interest of researchers and practitioners in the proposal to use the BCM as an EAM tool in horizontally cooperating companies (P2 and P3), we also examined its creation and development in an interorganizational setting. To compare the modeling processes in single and multiple organizations, we conducted a structured literature review to identify literature describing the development process in a single organization. Based on four case studies, we have analyzed documents and protocols of interorganizational EA initiatives and performed semi-structured interviews to design, evaluate and revise the derived process. After comparing the resulting reference process with techniques of modeling business capabilities in a single organization, we could identify several discrepancies but also similarities.

Besides the four embedded publications in this dissertation, we have published one additional paper, which has directly affected the research endeavor presented in this dissertation (see Table 1.2).

P5: Investigating the Challenges of European Public Service Media Companies from an Enterprise Architecture Point of View

By conducting a multiple-case study, we have investigated the challenges of four European public service media companies with regard to digitalization from an EA point of view [YM19]. As a result, we were able to identify six challenges, three of which are current problems and three of which are potential challenges in the future. Half of the interviewees mentioned "silo mentality" as one present problem. The investigated case study partners complained about an isolated

Table 1.2.: Additional publication

RQ	No.	Title	Authors	Outlet	Type
-	P5	Investigating the Challenges of European Public Service Media Companies from an Enterprise Architecture Point of View	• F. Yılmaz • F. Matthes	TEAR 2020* (CORE: **B**)	Workshop

Legend:
TEAR: Trends in Enterprise Architecture Management Research
CORE: Computing Research & Education Ranking
* Publication is peer reviewed and published

way of working and hardly any communication between business partners, which even led to a different understanding of business and technical terms. From the perspective of EAM, we have proposed to address this communication problem by implementing a BCM. This challenge in the media industry and our proposition has motivated us to take a closer look at the research field of interorganizational EAM and, more precisely, the use of BCMs in an interorganizational context. Additionally, the paper motivated us to systematically identify challenges in horizontal collaborations in the literature and evaluate them in practice. As an essential publication contributing to the discovery and work on the thesis' topics, we have attached this paper as full text to the appendix (see Appendix B).

Even though this paper and the lack of literature in this area led us to the topic covered in this thesis, we would like to highlight publications (P1-P4) as the main contribution to research and practice.

CHAPTER 2

Theoretical Background

This chapter introduces and defines the terms and concepts of central importance for the dissertation and all the underlying papers to create a shared understanding. The explained terms include the research fields of EA and EAM (see Section 2.1), to which this thesis and especially the papers [YM19] and [YAM20] are assigned. Furthermore, the concept of business capabilities (see Section 2.2) and the term collaboration (see Section 2.3) are introduced, which are mainly relevant for the papers [YSM21], [YM21] and [YFM21].

2.1. Enterprise Architecture and Enterprise Architecture Management

Various definitions of the term EA can be found in the Information System (IS) research field [IEE00, Sch08, KSS15, RWR06, ARW08, Kel17, BBL12]. In the late 1980s, John Zachman presented a first attempt to outline the term architecture in a structured manner [Zac87]. He defined it as a set of representations with distinct purposes relevant to describe an enterprise. However, a variety of papers in the area of EA [ARW08, Kel17, BBL12] refer to the definition of architecture provided by ANSI/IEEE standard 1471-2000. Their definition is as follows: "The fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution" [IEE00]. The Open Group, as a global consortium developing technology standards, also refers to this definition presented by the Institute of Electrical and Electronics Engineers (IEEE) [Gro18b]. However, based on this definition, they have developed an additional description of architecture: "The structure of components, their inter-relationships, and the principles and guidelines governing their design and evolution over time" [Gro18b]. In summary, the aim of EA is to provide a holistic view of an organization [L+13] through a collection of representations of

the organization's foundations [ARW08]. From a technical perspective, the main objective of EA is to simplify the IT landscape of an organization by balancing the IT costs, its complexity, the planned changes, and the competitiveness of the organization [BBL12]. Taking these objectives into account, Bente et al. present a definition of EA by considering the different statuses of an IT landscape and its transformation [BBL12]. Therefore, in the further course of this dissertation, we refer to the following definition of EA:

Definition

Enterprise architecture is the representation of the structure and behavior of an enterprise's IT landscape in relation to its business environment. It reflects the current and future use of IT in the enterprise and provides a roadmap to achieve a future state. [BBL12]

2.1.1. Layers of EA

In literature, several layered models of EA are proposed [Sch04b, WF06, Buc11, WS08]. These models attempt to divide the organization as a complete unit into several layers that build on each other hierarchically. Each level represents a self-contained entity. Nevertheless, the levels are directly or indirectly interconnected via cross-sectional functions [WF06, Buc11]. In these models, both the business and the IT levels are taken into account and presented in a consolidated form.

Figure 2.1 illustrates a layered concept presented by Winter and Fischer [WF06]. They propose a hierarchical cross-layered view consisting of five layers supported by the EA as a cross-sectional function. In their attempt to divide an organization into levels, they notice that each level also consists of several artifacts that hierarchically build on each other. Consequently, each level is an aggregation of several artifacts of which it consists. The cross-sectional EA part "can be defined as the view that represents all aggregate artifacts and their relationships across all layers" [WF06]. The remaining layers of the cross-layered view are described by Winter and Fischer as follows.

The business architecture layer differentiates from the other layers by "representing the fundamental organization of the corporation (or government agency) from a business strategy viewpoint" [WF06]. According to the Open Group, business architecture can be defined as "a representation of holistic, multi-dimensional business views of: capabilities, end-to-end value delivery, information, and organizational structure; and the relationships among these business views and strategies, products, policies, initiatives, and stakeholders" [Gro18b]. This definition is also in line with Figure 2.1, which illustrates the relationships between multiple artifacts within the business architecture. For Winter and Fischer, possible artifacts would be a "hierarchy of organization goals and success factors, product/service model (including partners in value networks), targeted market segments, core competencies, strategic projects, maybe business principles, [and] dependencies between these artifacts" [WF06].

The fact that processes are highly relevant in the corporate context was already identified in the 1960s [Lev60]. They are defined as "structured, measured sets of activities designed to produce

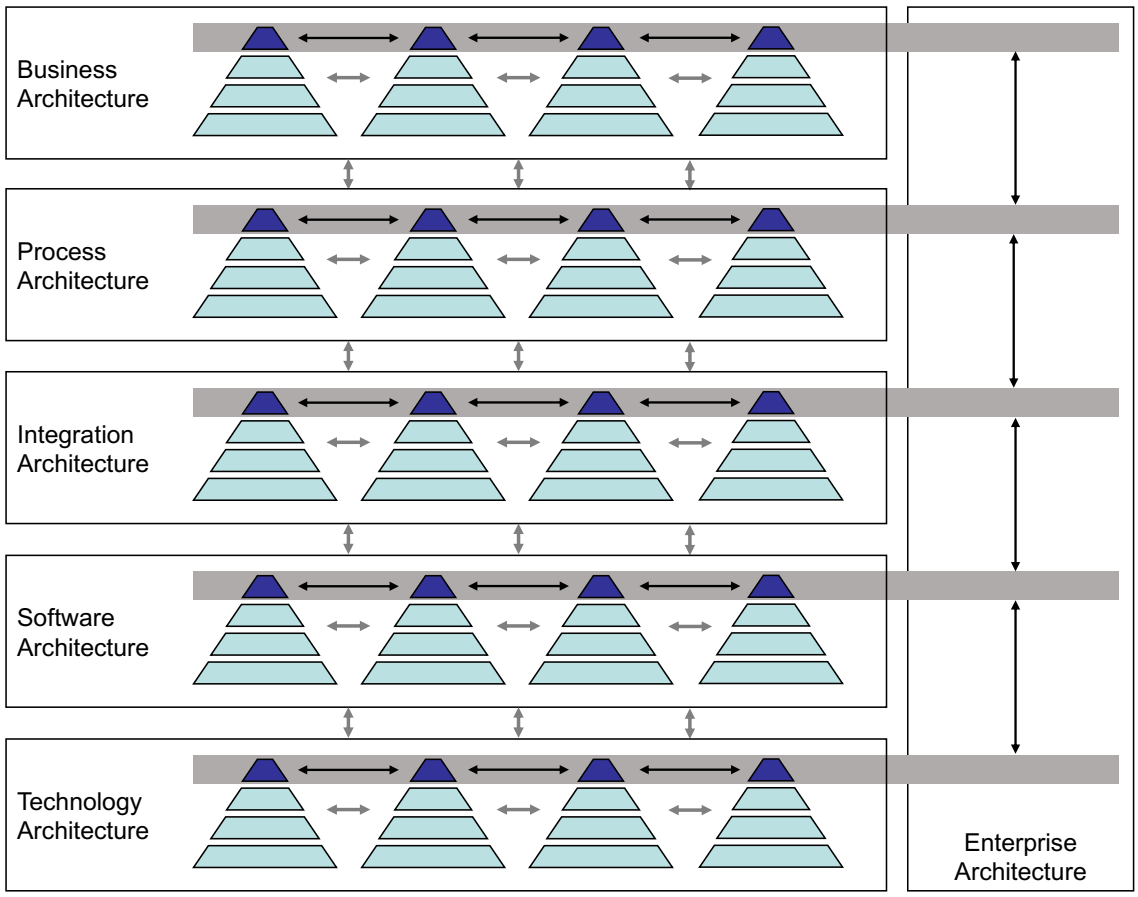

Figure 2.1.: EA as a cross-layer view [WF06]

a specific output for a particular customer or market" [Dav93]. Winter and Fischer present a more specific definition of process architecture: It "represents the fundamental organization of service development, service creation, and service distribution in the relevant enterprise context" [WF06]. But they also refer to the typical process architecture artifacts presented by Davenport: business processes, organizational units, responsibilities, performance indicators, and informational flows [Dav93].

From an IS point of view, Winter and Fischer state that integration architecture "represents the fundamental organization of information system components in the relevant enterprise context" [WF06]. However, from a general perspective, enterprise integration should address the entire organization and focus more on the organization than on the technology [CCG01]. In line with this definition, Winter and Fischer present "enterprise services, application clusters, integration systems, and data flow" as possible artifacts [WF06].

The layer of software architecture "represents the fundamental organization of software artifacts, e.g. software services and data structures" [WF06]. Even if Winter and Fischer do not present

specific artifacts for this layer, they refer to "design and evolution principles from computer science" [WF06] research.

The technology architecture serves as the foundation of the model presented. This is also referred synonymously with the term information architecture [WF06]. For design and evolution principles, reference is made to the research field of computer science. "computing/telecommunications hardware and networks" are listed as typical artifacts [WF06].

As aforementioned, further layered models of EA exist in literature [Sch04b, WF06, Buc11, WS08]. Each model describes EA from a different perspective. For example, unlike Winter and Fischer's [WF06] model, Buckl's [Buc11] model emphasizes EA demands. Consequently, the EA itself is divided into layers and constitutes not only a cross-sectional function. The holistic view on EA presented by Buckl [Buc11] is illustrated in Figure 2.2.

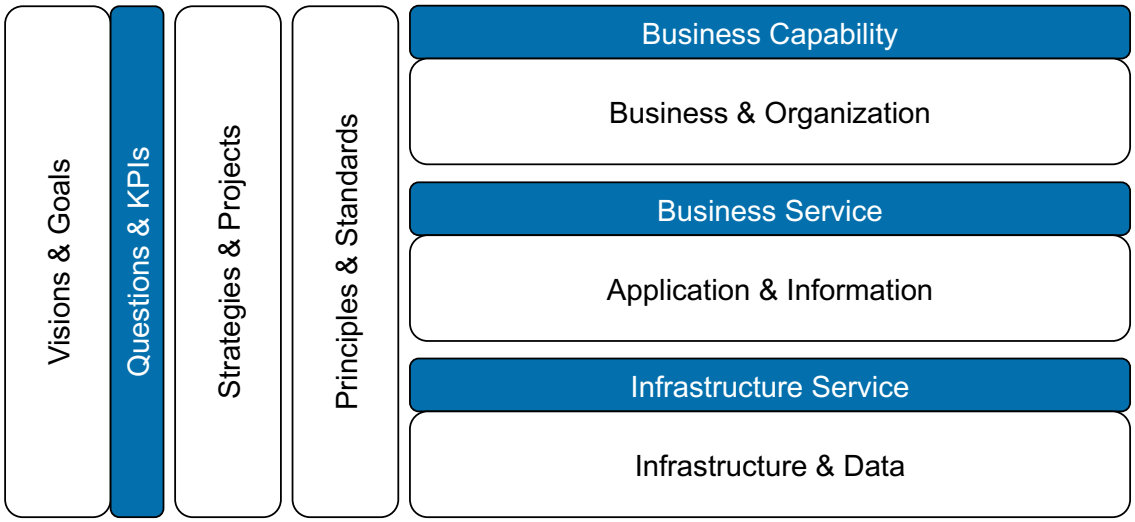

Figure 2.2.: Holistic view on EA [Buc11]

In contrast, the five-layered EA model presented by Winter and Fischer [WF06], Buckl [Buc11] presets a model consisting of only three layers. In terms of content, however, the two models overlap considerably. As a standout feature, the view on EA presented by Buckl includes three cross-cutting functions that influence the design of the EA. Some of the layers and cross-cutting aspects are accompanied by additional abstractions.

The business & organization layer describes the organization-related aspects of the enterprise. This layer is primarily supported by the artifact business capability, to which special attention is devoted in this thesis. It describes the core competencies of an enterprise which are necessary for creating value [FMSN11]. This artifact will be described in more detail in Section 2.2.

The application & information layer comprises all applications and their interfaces to each other. Based on applications, a variety of business services can be realized, which is illustrated as the abstraction of this layer.

The infrastructure & data layer corresponds to the technology architecture layer presented by

Winter and Fischer [WF06]. It provides the foundation for the previous layers by containing the technical infrastructure components which are necessary to provide infrastructure services to the enterprise.

The cross-cutting aspects, which are illustrated vertically, encapsulate the architecture layers. The purpose and aim of an organization are captured in its vision & goals. KPIs help to measure and answer questions related to the defined objectives. The resulting strategies are realized by carrying out projects. To ensure a certain degree of consistency and standardization within the organization, the needed changes are performed on the basis of principles & standards.

2.1.2. Enterprise Architecture Management

The utilization of the previously mentioned layers of EA (see Section 2.1.1) in order to achieve the alignment of the organization's business and IT is referred to as the discipline of EAM [BBL12]. In line with the cross-cutting aspects presented by Buckl [Buc11], it targets the organization's strategic goals, business products, and assets by continuously measuring KPIs [BBL12]. Based on this, a process of activities is defined, which leads the enterprise from an as-is state to a to-be state to achieve its objectives [Kel17, BBL12]. Its "goal is a common vision regarding the status quo of business and IT as well as of opportunities and problems arising from these fields, used as a basis for a continually aligned steering of IT and business" [MBLS08].

Even though several researchers in recent years have addressed this research field, different definitions are presented with significant overlaps in content [MBLS08, WF06, ASML12, L$^+$13]. Nevertheless, the interpretation of the term EAM depends strongly on the respective author. To ensure unambiguity, we refer to Ahlemann et al.'s [ASML12] holistic definition in this thesis:

Definition

Enterprise architecture management is a management practice that establishes, maintains, and uses a coherent set of guidelines, architecture principles, and governance regimes that provide direction for and practical help with the design and the development of an enterprise‘s architecture in order to archive its vision and strategy. [ASML12]

According to this definition, the EAM practice does not relate to a mere management function of the IT infrastructure but instead has an explicit business emphasis. As a result, it is possible to infer that there are benefits in implementing EA for an organization, as documented in the literature [ARW08, Han16, TSSR11]. The resulting benefits include business-IT alignment, decreased IT expenses by enhanced decision-making, regulatory compliance, and reduced IT complexity [TSSR11].

To operationalize the adoption and use of EA in the enterprise, a collection of EAM best practices, methods, techniques, documentation procedures, analysis, and communication is required. As a result, various EA frameworks have been developed over time to serve distinct goals and meet the interests of diverse stakeholders to promote EAM [Mat11]. The Open Group Architecture Framework (TOGAF) [Gro18b] and Zachman Architecture Framework [Zac87] are two of the most prominent frameworks.

To support enterprise architects in their work, several companies offer tools for targeted data collection and analysis to make statements about the company's current and future business and IT architecture [MBLS08].

2.1.3. Interorganizational Enterprise Architecture

In previous sections, EA and the management of this field have always been presented from the perspective of a single company. Driven by the benefits of EAM, companies are concerned with the introduction, expansion, and extension of EA and its management. However, they often overlook the fact that their IT and business processes are not isolated from those of other companies [DS14]. Instead, today's businesses are increasingly connected with their partners in collaborative networks and operate in complicated business ecosystems [CMA08].

As a result, cross-enterprise development and deployment of IT systems have already been extensively addressed in IS research [JV88, MR08, ZFT11]. The isolated consideration of cross-company business processes is also the subject of existing literature [MSLH02]. As already mentioned in the last sections, however, the subject area of EA extends far beyond these two fields. The first approaches in the form of a framework value, which consider external influencing factors in the design of EA, are presented at the beginning of 2000 [Sch04a]. In the following years, attempts are made to extend existing frameworks with cross-enterprise elements [MSS+13, GVL04], or completely novel approaches are presented [VBCO13]. Nevertheless, there was a realization that the field of research in this area was still relatively unexplored [Tam17].

Since a variety of forms and gradations exist in enterprise collaboration [CMA08], it is challenging to define EA across enterprises in a uniform way. To fill this gap, Drews and Schirmer presented several levels, ranging from EA in a single enterprise to a business ecosystem architecture (Table 2.1).

The first level represents the EA in a single company. We explained this discipline in Section 2.1. In the second level, namely Extended Enterprise Architecture (EEA), the EA of an organization is extended by "external entities like customers, partners, and suppliers" [DS14]. During the creation of the models, there is usually no information exchange with external partners. This interaction does not occur until the third level of Drew and Schirmer's Model, which is called Federated or Collaborative Network Architecture (FA/CNA). In this architecture form, the parties involved exchange information and even agree on certain parts of their architecture. Drews and Schirmer call this section of the respective architectures, which is relevant for collaboration, "boundary architecture" [DS14]. In this context, an organization in a leading role can manage the exchange of information. In the next stage, "a central actor decides to analyze details of its customers', partners' or suppliers' EA in order to plan and accomplish interventions that will affect these actors" [DS14]. This level is called Focused Business Ecosystem Architecture (FBEA). Often these cross-enterprise EA models are requested by vendors to gain an overview of their customers' architecture [DS14]. The last level describes the business ecosystem in its entirety. It is called the Business Ecosystem Architecture (BEA). This level is necessary, for example, when new healthcare standards are defined, affecting all parties in this ecosystem [DS14].

Furthermore, Drews and Schirmer have identified multiple challenges associated with "modeling

Stage	(Extended) Focus
Enterprise Architecture (EA)	core business, internal focus
Extended Enterprise Architecture (EEA)	EA + customers, partners, and suppliers - modeled and managed from a focal actor's perspective
Federated or Collaborative Network Architecture (FA/CNA)	EEA + several actors in a network are exchanging selected parts of their EA and negotiate about standards, interfaces, inter-organizational processes, etc. due to a common interest or project
Focused Business Ecosystem Architecture (FBEA)	FA/CNA + EA of selected customers, partners, and suppliers / reference EA, to-be/reference EA of customers modelled by a software vendor
Business Ecosystem Architecture (BEA)	FBEA + general overview of infrastructure and interfaces to all connected EA, including details of many actors' EA

Table 2.1.: Stages from EA to BEA [DS14]

and managing" [DS14] these forms of interorgaizational EA. These and other challenges were confirmed and addressed in papers P2 and P3 of this dissertation. More details can be found in the attached publications.

2.2. Business Capabilities

The term business capability is composed of the words business and capability. For the term capability considered as such, there are a variety of definitions from different research fields [KLFK10, US04, Gra96, Gro18a]. Becker et al. describe a capability as "a manageable unit of change and supports incremental development through an explicit distinction between systems and their capabilities" [BAB+11]. The U.S. Department of Defense presents a more general definition. The Department of Defense Architecture Framework defines capabilities as "the ability to achieve a desired effect under specified standards and conditions through combinations of means and ways to perform a set of tasks" [oD10].

Offerman et al.'s systematic literature review of business capabilities in IS research shows that two streams of research have emerged in this field. The resource-based perspective and the perspective from the EA [OSP17]. From a resource-based view, "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" [Bar91]. However, due to the topic in this dissertation, we will focus on a view from an EA perspective.

The Open Group describes a capability as "an ability to do something" and defines a business capability as "the ability for a business to do something" [Gro18a]. From an IT-oriented perspective, business capabilities are intended to create a link between business and IT by creating a common language across all stakeholders [SEK07]. Therefore, business capabilities describe

the interaction of "processes, resources and people" [KLFK10]. However, other views and definitions exist in IS research [Fre14, AKHV+18, BBG+15, SGHZ12, ZSHG13]. For a unified understanding in this thesis, the definition presented by Offerman et al. is used, which is stated as follows:

Definition

[*Business capability* is] a particular ability that a business may possess or exchange to achieve a specific corporate goal. [OSP17]

Their understanding of business capabilities is based on two major definitions of business capabilities, which resulted from their systematic literature review. The first definition describes a business capability as "a particular ability or capacity that a business may possess or exchange to achieve a specific purpose or outcome" [Hom06]. The second definition describes it as "a corporate business goal the aim of business capabilities is to activate, use and maintain resources for specific business activities" and is presented by Wißotzki [Wiß15].

Although research does not provide a clear definition of business capabilities, there is widespread agreement that business capabilities describe *what* an organization does and not *how* [UR11]. Furthermore, business capabilities are assigned the following characteristics [WS15, OSP17, UR11, Fre14, BMH05]:

- Abstract and encapsulate any resources, including processes, people, and IT components
- Remain stable over time
- Do not overlap in their content and are mutually consistent
- Can be broken down hierarchically into sub-capabilities with finer granularity
- Expressed in business terms rather than technical terms

Capability-based planning refers to the management of business capabilities and the models that derive from them. It contains the entire process of obtaining business capabilities, including "the planning, engineering, and delivery of strategic business capabilities to the enterprise" [Gro18b].

2.2.1. Business Capability Map

A BCM illustrates the organization's business capabilities with their relationships with each other [KLFK10, Gro18b]. It serves as a blueprint, visualizing its abilities for several business and IT stakeholders [Gro18b]. This makes it possible to assess capabilities from a strategic standpoint [BMH05].

Various visualization alternatives for business capabilities are presented in the literature. For example, Klinkenmüller et al. suggest that capabilities could be arranged in a three-dimensional model along a hemisphere [KLFK10]. Nevertheless, the majority of researchers rely on a hierarchically nested two-dimensional view that resembles a map [AKHV+18, BMH05, UR11, BFM18].

In line with this description and based on the findings of Gant [Gra96], Beimborn et al. define a BCM as follows:

Definition

The *[business] capability map* is a nested hierarchy of capabilities and a taxonomic diagram that describes the interplay of capabilities while doing business. [BMH05]

That BCMs are a prevalent EA artifact is shown in a recent study conducted by Aleatrati Khosroshahi et al. In a survey in which 25 organizations participated, 23 confirmed that they use a BCM in their EAM activities. This represents 92% of the respondents [AKHV+18].

In the same study, the authors wanted to give answers to questions about how business capability models are implemented in practices and identify their potential applications. In the interviews, 14 predefined use cases were presented and evaluated. The findings show that most enterprises use business capability models to support strategic decisions, improve communication between IT and management, increase transparency, and design target states of architecture [AKHV+18]. To achieve this, the BCM is often enriched with further information, such as applications and technologies, to make statements about harmonization potential, IT costs, and application lifecycle or mapped to additional business components like business units or value streams [AKHV+18, BFM18, ZSG18, Gro18a]. Further, a BCM allows managers to make outsourcing decisions by visualizing the role of external partners [BMH05]. In the case of outsourcing a capability, the map's structure remains unchanged because the capability is still part of the company but is operated externally [BMH05].

Figure 2.3 shows an exemplary BCM, as it is often found in the literature. In order to highlight the relevance and strategic importance of each business capability, it is recommended to divide the capabilities into the groups "strategic", "core", and "supporting" [Gro18a]. Even though there is broad agreement among researchers on this categorization, slight variations can be found [UR11]. This segmentation allows stakeholders to focus on the capabilities that concern them and conduct targeted analysis and forecasting for the relevant business capabilities.

The map consists of specific top-level capabilities, which in turn may consist of several low-level capabilities. This allows certain domains in the company to be represented more precisely, enabling different stakeholders to extract the appropriate degree of information [BFM18]. For example, the executive level of an enterprise might utilize the top-level capabilities as a foundation for strategic decisions [BFM18]. According to Ulrich and Rosen, the decomposition of a business capability "provides a better sense as to how capabilities fit in the overall view of the business" [UR11]. However, different opinions exist about the granularity and the levels of a BCM in literature. While Keller et al. suggest a hierarchy consisting of 5-7 levels [Kel09], report Bondel et al. from an implementation of a BCM with only two levels [BFM18]. Ulrich and Rosen argue that a BCM should be decomposed into "levels 1-3 for purposes of planning and levels 4-6 for purposes of detailed business/IT mapping" [UR11].

A BCM can be modeled in one of two ways. According to the "top-down approach", the organization starts with general, high-level capabilities and then decomposes them into lower-level capabilities [Gro18a]. The counterpart is the "bottom-up approach". Following this procedure, the modeling starts with lower-level capabilities, which are aggregated into high-level capabilities

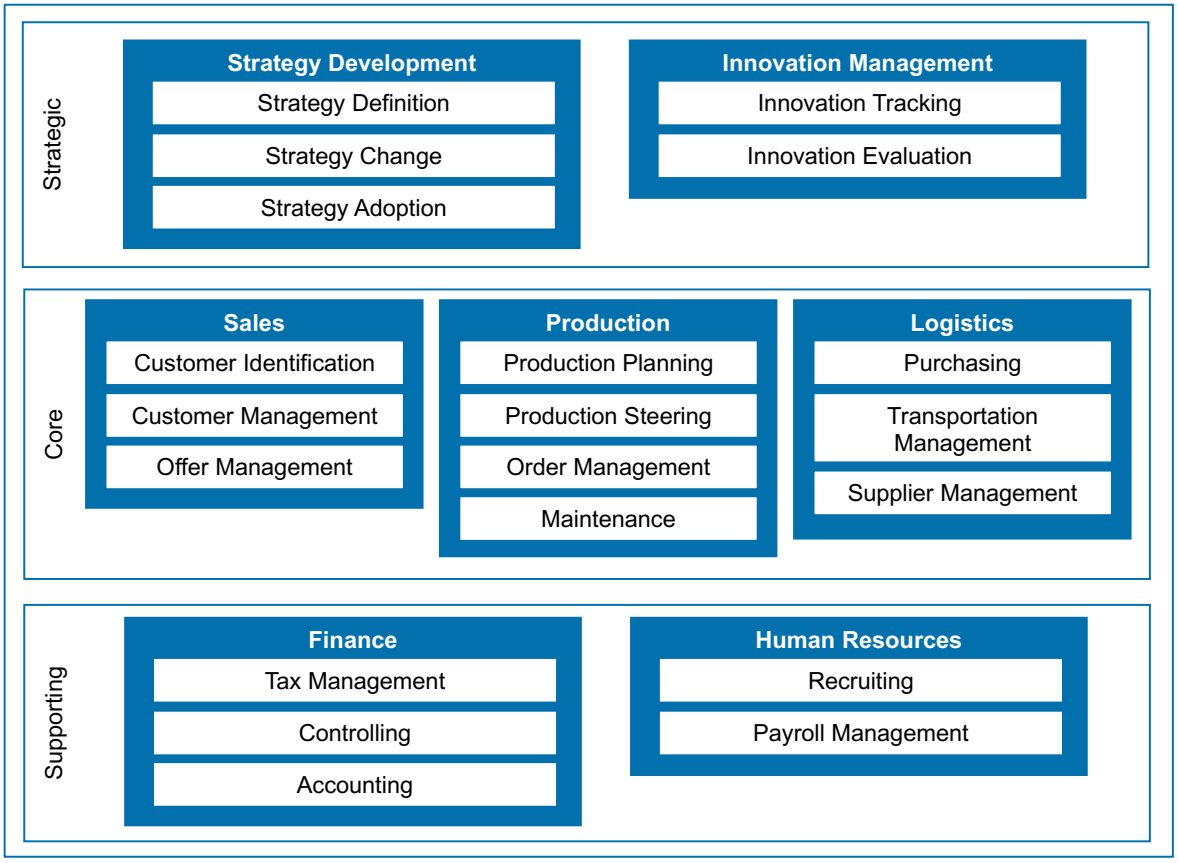

Figure 2.3.: Exemplary BCM

[Gro18a]. In addition, the model can also represent vertical and horizontal relationships between business capabilities. The hierarchical dependency represents the vertical relationship. The horizontal relations "describe how business capabilities interact with each other" [KLFK10].

In order to measure business capabilities, they are enriched by additional data [Kel09]. Various terminology is used in the literature to describe these evaluative indicators [BMH05, AIVH+15]. Depending on the respective indicator, the BCM can be visually highlighted using color-codings. This illustration of a heat map allows comparisons between individual business capabilities and shows fields of action and improvement [BFM18, Gro18a].

2.3. Interorganizational Collaboration

In literature, different terminologies exist to describe the relationship between companies and their partners. These interactions between organizations are often differentiated using the terms coexistence, competition, cooperation, and coopetition [BK99, PY16]. These four types of interorganizational relations are described and defined in the following.

Coexistence is a passive relationship that "does not include any economic exchange, merely information and social exchanges" [BK99]. Even though organizations know about each other's existence, they do not establish a relationship [BK99]. They usually keep their distance and do not interfere with each other. The companies' objectives are set independently [BK99].

Competition implies rivalry between companies that want to improve the achievement of their own goals, possibly at the expense of another company [SFN01]. Power and dependency are allocated evenly across the organizations in a competitive relationship [BK99]. In addition, competing companies may even obtain their resources from the same supplier [BK99]. Organizations with a strong market position and not reliant on the competitor's resources are more likely to seek interaction or relationships with other competitors [BK99].

In contrast to competition, cooperation describes the interaction between legally independent companies frequently exchanging information on a business or social level in order to accomplish shared objectives or tasks [BK99, Blo80, Boe86]. However, the concept of mutuality applies not only to the common goals [SS02] but also to the benefits [EE96] and risks [BCC+98, MM00] of cooperation. Even if cooperation "is a self-interested process in which firms will participate only if it contributes to their own survival" [SS02], "the focus of a mutual objective should be on the outcome and experience of joint offers" [SS02]. Cooperating organizations can either be companies from different industries or direct competitors. Consequently, cooperation does not imply that companies engaging in cooperation do not compete [BK99]. However, they have to be economically independent in the non-cooperating areas [Blo80]. Cooperation might comprise a formal agreement, such as the formation of a strategic alliance, or an informal agreement based on social norms and trust [BK99, Blo80]. According to Bengtsson and Kock, conflicts in cooperation are uncommon as a result of the firms' adjustment of power and dependency [BK99].

Raymond John Noorda was the first to introduce the term coopetition [NB97]. However, no clear definition exists in the literature [GFGK15]. Even though the term coopetition is composed of the two words "cooperation" and "competition", it is more than a contextual combination [MKO07]. It comprises both concepts: Regarding the cooperative part, each organization's authority results from functional components and reliance is ensured by formal agreements or trust [BK99]. The cooperation can pursue either economic or non-economic goals [BK99]. Before they properly start cooperating, the norms and goals must be defined precisely by both sides [BK99]. Further, this form of interaction also includes competitive aspects like object-oriented goals, dependencies, norms, and power. Even though some of the characteristics strongly depend on the actor's position in the coopetition, they are usually equally distributed [BK99].

The collaboration between organizations, which was observed in the context of this thesis, corresponds to the interaction form of cooperation. Furthermore, in this thesis, the terms cooperation and collaboration are used synonymously.

2.3.1. Direction of Collaboration

Collaboration has multiple characterizing facets [MRD+05]. In addition to the psychological [SH00], sociological [PWKOS05], and marketing disciplines [GHH03], collaboration can be differentiated based on the supply chain [HDHS05].

A fundamental distinction is made between internal and external collaboration [Bar04]. The former refers to collaboration within an organization and its internal supply chain activities [Ell00]. External collaboration extends this relationship to include customers, suppliers, competitors, and other organizations [Bar04]. However, internal and external collaboration are interdependent. Mark Barratt describes this situation as follows: "Internal collaboration must be married with external collaboration, in terms of developing closer relationships, integrating processes and sharing information with customers and suppliers" [Bar04]. In this thesis, only cross-company collaboration is covered. Internal collaboration is not part of the thesis.

Collaborative processes involve information exchange among independent supply chain partners [SDA99]. As an extension, a collaborative supply chain involves "two or more independent companies (that) work jointly to plan and execute supply chain operations with greater success than when acting in isolation" [SS02]. Organizations collaborate in order to develop, maintain, and improve supply chain capabilities which lead to improved company results and, consequently, competitive advantage [HPL03].

The literature distinguishes between three different directions of collaboration based on the supply chain: vertical, horizontal, and diagonal [SS02, Bar04, CDF07]. Figure 2.4 shows an overview of the collaboration directions.

Vertical cooperation involves companies that belong to different stages of the value chain. The cooperating companies represent a typical supplier-customer relationship [Bar04]. It "occurs when two or more organizations such as the manufacturer, the distributor, the carrier, and the retailer share their responsibilities, resources, and performance information to serve relatively similar end customers" [SS02]. This is often accompanied by an exchange of financial resources [EA16]. For example, the retail company would collaborate with the logistics service provider or the automotive company with numerous suppliers.

Horizontal partnerships, on the other hand, are more casual and inconspicuous [BK99]. They also do not necessarily contain economic exchange. Often, horizontal relationships are based on social interaction and information exchange [BK99]. As shown in Figure 2.4, horizontal collaboration occurs between organizations at the same value chain stage. The offered services or products are at least similar or even identical. Further, they can base on the same technologies or the same production process [Hag04]. For example, Simatupang and Sridharan cite the exchange of "private information or resources such as joint distribution centers" [SS02].

Compared to vertical and horizontal collaboration, diagonal collaboration is relatively unexplored [SH15]. "A lateral collaboration aims to gain more flexibility by combining and sharing capabilities in both vertical and horizontal manner" [SS02]. If the companies belong to different industries, they cooperate diagonally or in a complementary way [Hag04]. Such a form of cooperation can connect the supply chains of different companies at different stages [CP12].

Chan and Prakash show a possible use case of diagonal collaboration from the field of inventory management and point out the benefits compared to horizontal collaboration [CP12].

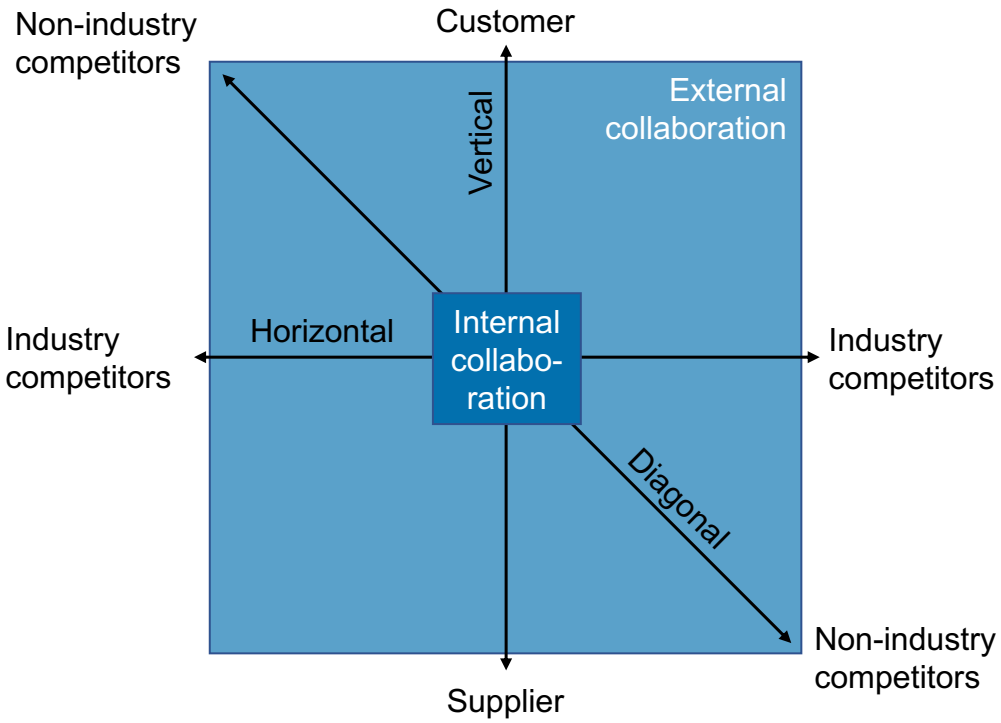

Figure 2.4.: Collaboration directions related to the value chain [Bar04, Hag04]

2.3.2. Collaboration Forms

While it is possible to clearly distinguish between different collaboration directions [SS02], there is no consensus in the literature on collaboration forms [GFM03]. Often scientists have different perspectives on collaborations when defining different types [CPJ99, REH+04].

Lambert et al. [LEG99] and Golicic et al. [GFM03] have both attempted to differentiate between types of collaboration based on integration levels. They start from the extreme of an arm's length collaboration which consists of primary and repeatable transactions [Hei94, WJ92]. Lambert et al. present joint ventures as the other extreme of integration [LEG99]. Golicic et al. name the highest level of integration "(vertical) integration" [GFM03]. Even though the authors name this integration stage differently, they overlap considerably in terms of content. In this stage, one or several organizations perform all supply chain activities as one unit [Hei94, WJ92, MDK+01]. In horizontal collaboration, this stage is even described as a merger between companies [CDF07]. Between the two extreme forms of collaboration, the authors of the first concept propose three levels "of partnering or integration" [LEG99]. They distinguish between coordinating relationships (Type I), integrated activities (Type II),

and significant integration (Type III) [LEG99]. The authors of the second breakdown admit that "cooperative relationships are not as clearly defined" [GFM03]. "While there is some agreement in the literature that these terms mean working together toward common goals and sharing investments" [GFM03], a concrete definition does not exist. Figure 2.5 shows a simplified representation of both concepts.

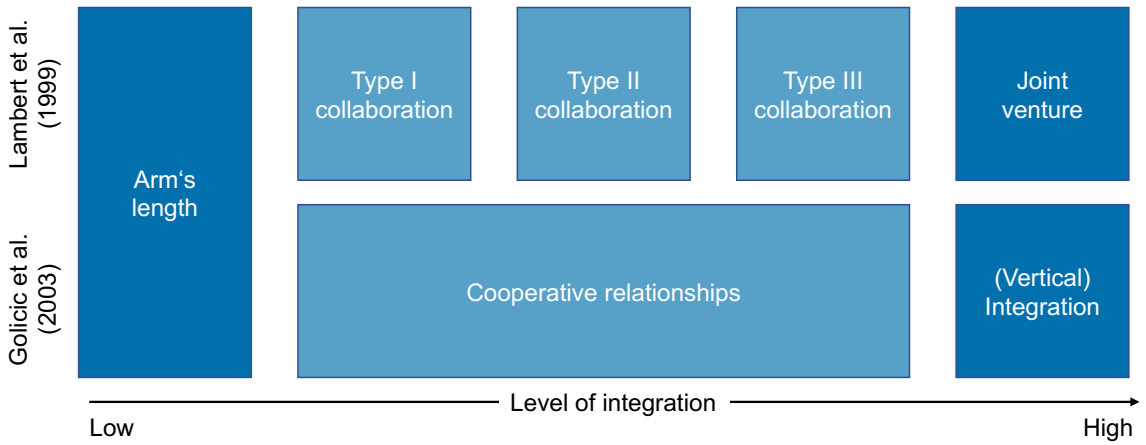

Figure 2.5.: Levels of integration [LEG99]

Cruijssen et al. agree that a gradation between arm length and integration is rather elusive: "In between these two extremes, however, there exists a plethora of cooperation types and/or names that can be perceived as "fuzzy" and lacking structure". [CDF07]

Lamert et al.'s Type III collaboration is considered in literature often as a strategic alliance [CDF07]. This collaboration form is characterized as a long-term formal arrangement between two or more companies to trade and combine part of their resources [BHK93]. Todeva and Knoke distinguish between 13 different types of strategic alliances [TK05]. This range demonstrates the complexity and disagreement in the field.

Another approach to differentiate forms of cooperation is presented by Zinn and Parasuraman. They distinguish forms of collaboration based on a matrix that takes into account the scope and intensity of the collaboration [ZP97]. Still other researchers use a morphological box including the most relevant dimensions of collaboration (e.g., the direction of collaboration, the field of collaboration, degree of interdependence, type of contractual agreement, and space of cooperation) to identify the collaboration type [RD94, Kil11]. These different approaches to identify and distinguish collaboration types underline the complexity of this research field and the variety of existing collaboration forms.

To classify the case study partners used in the underlying publications of this thesis, we refer to the collaboration forms given by Kietzmann et al. In their study, they distinguish between nine different collaboration constellations [KPE+13]. Table 2.2 represents an excerpt of the two collaboration forms relevant to this thesis, which Kietzman et al. define based on criteria "control", "temporal or boundary focus", and "basis of relationship" [KPE+13].

	Control	Temporal or boundary focus	Basis of relationship
Work groups	Under organizational control	Within organizational boundaries or across organizational boundaries	Project focused or ongoing
Communities of practice	Self-organized/ under control of the individuals(s)	Long term, ongoing no regard to functional, hierarchical, or organizational boundaries	Based on professional expertise and practice-based relationships Members produce a shared practice as they engage in a collective process of learning

Table 2.2.: Relevant collaboration forms [KPE+13]

- **Work groups:**
  According to Kietzman et al.'s research, one characteristic of "work groups" is the control of one or many organizations. Consequently, the collaboration and its constellation are mandated by the organization. The collaboration can take place both within and outside the organizational boundaries. Depending on the collaboration project, the relationship can be short- or long-term [KPE+13]. In line with these characteristics, other researchers define "work groups" as follows: "Work groups are often used as a means for connecting members who are dispersed across different geographic locations, who represent different functions, who report to different managers, or who work in different business units" [Cum04].
- **Communities of practice:**
  The characteristic in which "work groups" and "communities of practice" differ most is the control structure. Unlike in a "work group", in a "community of practice", "people participate and voluntarily exchange valuable, personal knowledge with other members in the community" [WF00]. This self-organizing aspect significantly distinguishes these two collaboration forms. As one who first proposed this concept, Etienne Wenger defines a "community of practice" as: "Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" [Wen99]. In a later publication, he presents a more detailed definition: "Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" [WMS02].

All case study partners mentioned in this thesis and in the underlying publications can be assigned to one of these two types of collaborations.

CHAPTER 3

Research Design

The research design of this doctoral thesis serves as a guideline for research activities carried out in order to answer the research questions and consequently fulfill the research objectives. One important aspect of the research design is the selection of the research strategy [Bha12]. Secondly, appropriate research methods have to be selected to implement the chosen research strategy [Bha12].

3.1. Research Strategy

Every research endeavor consists of general philosophical assumptions underlying the research, which have to be tested by applying an adequate research strategy [Mye97]. Based on the research objectives, one of the two forms of scientific inquiry is to be selected by the researcher: Inductive or deductive research [Bha12]. The purpose of inductive research is to extract theoretical concepts from observations [EGS16, Loc07]. Further, deductive research, aims to evaluate theoretical notions from existing research by using empirical data [Bha12]. Depending on the selected scientific inquiry, an inquiry strategy has to be chosen to set the research design and the way how data is collected. In behavioral research, we can distinguish between three different inquiry strategies: quantitative, qualitative, and mixed strategies [CC18].

The goal of quantitative research is to comprehend and interpret qualitative data by exploring the interplay of a limited number of variables [Bry12]. Therefore, quantitative research is driven by numerical results and the interpretation that may be made of them. Prominent examples of quantitative methods are surveys or experiments [CC18].

In contrast to quantitative research, qualitative strategies strive to understand and describe complex or exceptional social and organizational occurrences. Given these characteristics and

the due to limited units of analysis, the results of qualitative research do not aim at generalizability [SC90]. Examples of qualitative methods are expert interviews and case study research [Bha12].

By combining qualitative and quantitative methods, the mixed methods research strategy benefits from the advantages of both inquiry strategies [JOT07]. Integrating quantitative and qualitative data allows the researcher to draw more reliable conclusions and produce a more profound knowledge of the phenomena of interest than independently using a qualitative or quantitative strategy [VBB13].

The objective of this doctoral thesis is to investigate the application and development of a BCM in an interorganizational context based on observations and case studies. No pre-existing theories have been incorporated into the definition of the research questions. Therefore, this research can be classified as inductive research. Even though mainly qualitative methods were used, quantitative strategies were also applied during the investigations. We used different methods depending on which strategy was more suitable for a research question. Through this mixed-methods approach, we could gain in-depth insights into the field of interorganizational EAM and use of BCM.

For each research question, we first applied an evidence-based approach by conducting a **structured literature** review to explore and identify existing related work: (RQ1) This resulted in six relevant literature on interorganizational EAM, which we summarized in P1. Unfortunately, none of the studies expressed enterprise architects' motivations for collaboration. (RQ2) The structured literature review also allowed us to uncover the typical challenges in horizontal collaborations, which we presented in P2. (RQ3) We were able to discover four papers from which the process for modeling a BCM in individual companies emerged. These have served as the basis for our investigation in the cross-company context, which we presented in P4.

Using an online **survey** in professional social media channels (e.g., LinkedIn), we undertook an initial investigation to analyze the prevalence of BCM in practice. The results of the survey confirmed the relevance of BCM across companies and encouraged us to conduct more detailed research in form of case study research. The survey results were published in P2.

We enhanced this quantitative data with qualitative data we collected by conducting a **multiple-case study** to identify the motivation of enterprise architects collaborating with each other (P1) and current use cases for interorganizationl BCM (P2 and P3). To answer the last research question, we proposed a process for defining and modeling BCMs with the insights we gathered from case study research (P4).

In the additional publication, which played a major role in identifying the first research gap, the research methods of structured literature review and multiple-case study were applied (P5).

In total, six case studies were conducted in this dissertation and 14 international companies from four different industries were examined. The next section outlines the research methods used to answer the research questions of this thesis.

3.2. Research Methods

This dissertation follows a mixed strategy of inquiry. We used both, quantitative and qualitative methods to answer the research questions of this thesis. In the following section, the used methods are introduced. This includes a short description and the steps to conduct in each of the three research methods. Table 3.1 summarizes the applied research methods in each embedded (P1-P4) and additional (P5) paper. A detailed description of the used methods can be found in the respective publication in the appendix.

Table 3.1.: Overview of research methods applied in the embedded (P1-P4) and additional (P5) publications

RQ	No.	Title	SLR	SUR	MCS
RQ1	P1	Why would Enterprise Architects work together? - A Multiple Case Study	●		●
RQ2	P2	Interorganizational Business Capability Maps: Use Cases for Horizontal Collaboration	●	●	●
	P3	Application of Interorganizational Business Capability Maps in Different Forms of Horizontal Enterprise Architecture Collaboration			●
RQ3	P4	Deriving a Process for Interorganizational Business Capability Modeling through Case Study Analysis	●		●
-	P5	Investigating the Challenges of European Public Service Media Companies from an Enterprise Architecture Point of View	●		●

Legend:
SLR: Structured Literature Review
SUR: Survey
MCS: Multiple-Case Study

3.2.1. Structured Literature Review

Reviewing existing research is fundamental for any academic research project [WW02]. A literature review ideally comprises all previous scientific works and knowledge on a specific research

domain in a structured way [WW02, Coo88]. According to Webster and Watson, “an effective literature review creates a firm foundation for advancing knowledge. It facilitates theory development, closes areas where a plethora of research exists, and uncovers areas where research is needed” [WW02]. The process of identifying and collecting relevant papers must be conducted in a transparent and replicable way to ensure the researcher’s credibility [VBSN+09]. Several publications offer instructions on how to thoroughly perform a structured literature review (cf. [WW02, VBSN+09]). To identify relevant papers, we used the overall process proposed by Brocke et al. [VBSN+09]. The “literature search” phase was conducted according to the four-step approach presented by Webster and Watson [WW02]. Figure 3.1 summarizes the applied literature review process in this thesis.

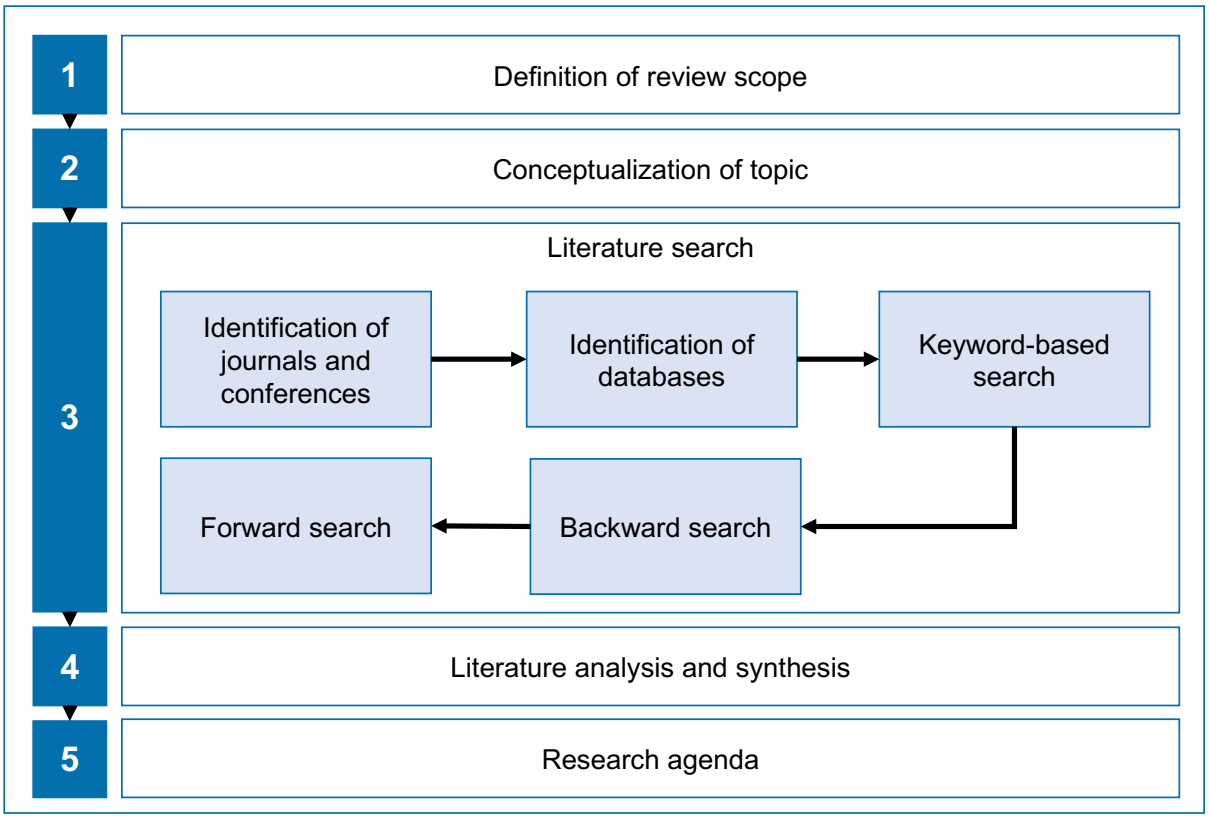

Figure 3.1.: Structured literature review approach [WW02, VBSN+09]

- **Definition of review scope:**
  Setting the right scope at the beginning of a literature review is key but also challenging [VBSN+09]. The reason is the wide range and diverse purposes of a literature review. It can be used to identify gaps in research, synthesize existing results, or identify commonly used research methods in a domain [Har98].
- **Conceptualization of topic:**
  In this step, "a broad conception of what is known about the topic and potential areas where knowledge may be needed" [Tor05] are identified. By analyzing sources providing

an overview of the topics of interest, first insights can be created. This can be done by consulting handbooks or seminal textbooks related to the topic [Bak00].

- **Literature search:**
  In order to reach an exhaustive coverage [Coo88] of relevant literature, we applied the four-step approach recommended by Webster and Watson (2002): Starting with the identification of relevant academic journals and conferences for the respective research topic, we focus on the selection of particularly high-quality contributions [VBSN+09]. Further, we select the databases containing publications of these outlets. As a main part of the process, a static keyword search is defined and applied to each database. A forward and backward search is conducted on the resulting papers to identify additional relevant articles.
- **Literature analysis and synthesis:**
  In this step, the relevant papers are systematically analyzed by reviewing the title, keywords, and abstract [VBSN+09]. This procedure aims to "assemble the literature being reviewed for a given concept into a whole that exceeds the sum of its parts" [LE06], resulting in knowledge gain [VBSN+09].
- **Research agenda:**
  The process is completed by the research agenda, which is "comprised of sharper and more insightful questions for future research" [VBSN+09, WW02].

We conducted structured literature reviews for each of the research questions of the thesis. By doing so, we could identify related work in the field of interorganizational EAM (P1). We could reveal typical challenges in EA collaboration (P2) and gather information on business capability usage and development in single organizations (P2 and P4).

3.2.2. Survey Research

The essence of survey research is "gathering information about the characteristics, actions, or opinions of a large group of people, referred to as a population" [Tan81]. Several approaches are presented to perform this empirical research method by scholars (cf. [PK93, LSHdM15]). In this thesis, we follow the approach proposed by Pinsonneault and Kraemer [PK93] (see Figure 3.2).

There are three different characteristics of research surveys [PK93]. First, survey research is utilized to quantify particular aspects of a given study population. Second, the information is gathered from people by defining structured questions. Their responses are always subjective. The third characteristic is the generalization of the findings by surveying a selected representation of the population.

The purpose of survey research can either be exploration, description, or explanation [Bab73, PK93]. The goal of *exploratory* survey research is to "become more familiar with a topic and to try out preliminary concepts" [PK93]. It allows the researcher to collect a set of responses and opinions representing a population of interest (e.g., enterprise architects). *Descriptive* surveys allow researchers to determine what situations, events, attitudes, or opinions are prevalent in a

population [PK93]. The purpose of survey research in *explanation* is to evaluate causal relations, theories, or explain trends in the population [PK93, WRH+12].

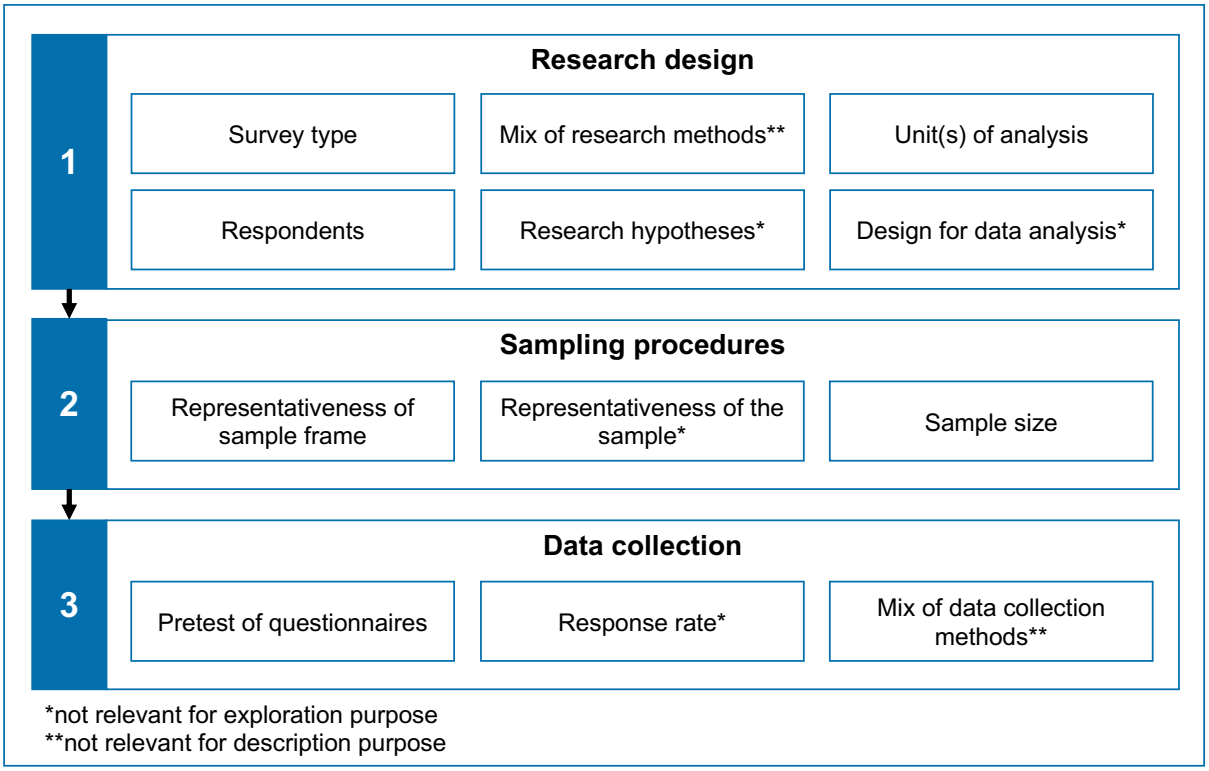

Figure 3.2.: Survey research approach [PK93]

- **Research design:**
  The *survey design* is based on the strategy of research chosen to answer the research questions and can be distinguished as cross-sectional and longitudinal [PK93]. For exploratory Pinsonneault and Kraemer recommend to use a cross-sectional to collect data at one point in time [PK93]. A longitudinal-designed survey collects data for multiple times. Additional *research methods* accompanying survey research can increase the validity of results. *Unit(s) of analysis* are the subjects of interest of which statements are being made about (e.g., individuals, organizations). *Respondents* refer to the surveyed roles in the study. Whether the researcher has focused on distinct roles or included multiple-role in the survey. Depending on the survey's purpose, the survey must be related to the *research hypothesis*. The *design for data analysis* is relevant for descriptive and explanatory purposes and focuses on statistical methods such as "simple descriptive statistics such as means and medians" [PK93].
- **Sampling procedures:**
  "Sampling is concerned with drawing individuals or entities in a population in such a way as to permit generalization about the phenomena of interest from the sample to the population" [PK93]. Therefore, the *representativeness of sample frame* is crucial.

It contains the selection of the correct population segment from which representatives are chosen. *Representativeness of the sample* which is actually selected is relevant for descriptive and explanatory studies. To increase the robustness of the results the researcher should choose a sufficient *sample size* depending on the purpose of the survey to represent the unit of analysis [PK93, Bab73].

- **Data collection:**
  The data collection begins with a *pretest of questionnaires*. The *response rate* is an indicator of whether the contacted representatives completed the survey in a given time frame. This can be improved by, for instance, designing short questionnaires. A *mix of data collection methods* is concerned with the application of multiple ways to collect data (e.g., online questionnaires) [PK93].

We strictly followed the described guideline while designing and conducting the survey in P2. The purpose of the survey we conducted in P2 was pure exploration. We designed a cross-sectional survey which is the typical survey type for the purpose of our study [PK93]. The results were enriched by using multiple methods in conjunction with the survey. By contacting mainly enterprise architects, we could collect first insights on the use cases and application of BCM in an interorgaizational context.

3.2.3. Case Study Research

The increasing demand to comprehend complex and contemporary social phenomena was the motivation behind case study research [BGM87, ESSD08]. As a social science research approach, case study research fills this gap by addressing contemporary occurrences in a real-world context [Yin15]. The case study method "also is relevant the more that your questions require an extensive and in-depth description of some social phenomenon" [Yin15]. Case studies allow researchers to improve knowledge of complex social situations by analyzing individual, group, organizational, social, political, and related phenomena [Yin15] which are defined as "the case" [Rob02]. The ability to combine appropriate research methods, such as surveys or experiments in case studies, is considered a strength of this research method [Yin15]. Case studies are typically applied in the domains of anthropology, business studies, psychology, sociology, and politics [Ger16]. Case study methods can also be used in IS research since this field also includes complex social phenomena [RH09]. Similar to survey research, case study research can be differentiated into exploratory, descriptive, explanatory, and improving case studies [RH09]. While *exploratory* case studies are applied to gain new perspectives on specific fields of interest, *descriptive* case studies are investigating a particular condition or state. *Explanatory* case studies aim to explain an existing problem or situation. *Improving* case studies seek to advance part of the previously studied phenomenon.

Yin proposes a case study research approach consisting of six steps. An overview of this approach is depicted below (see Figure 3.3).

- **Plan:**
  The success of the overall research effort depends on careful case study preparation and outlining the research objectives [RH09, Yin15]. Any case study should begin with a

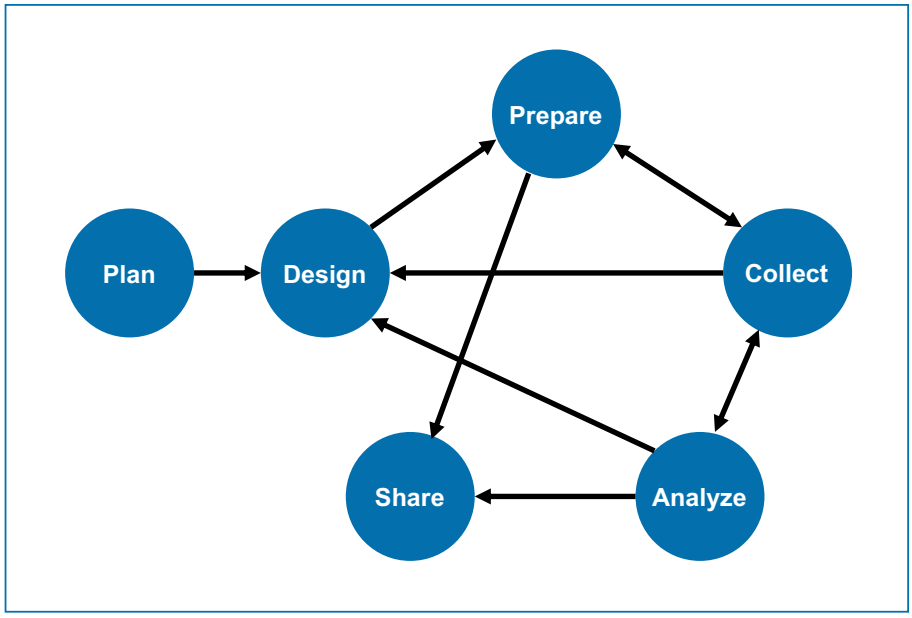

Figure 3.3.: Case study research approach [Yin15]

thorough examination of the literature, followed by a detailed evaluation of the study objectives and research questions [Yin15]. Benbasat et al. recommend to apply case study research when a natural setting in current occurrences has to be investigated, or a theoretical foundation is insufficient to explain the research phenomena. Further reasons are to leave events undisturbed or use natural settings as a basis for creating new theories [BGM87].

- **Design:**
  According to Yin, the case study design should include five steps: (1) Definition of the case study's questions in the form of research questions, (2) development of propositions derived from the research questions, (3) identification of the unit(s) of analysis to be studied, (4) the logic linking the data to the propositions and (5) the criteria for interpreting the findings. Additionally, these five steps are accompanied by quality measures to ensure the validity of the case study [Yin15]. Case studies can be classified into four designs (see Figure 3.4). The holistic approach includes a single unit of analysis, whereas the embedded approach analyzes multiple units. Depending on the number of cases, the design can consist of single or multiple cases.

- **Prepare:**
  The preparation phase is concerned with the requirements needed to be fulfilled before starting to collect case study data [Yin15]. First, a case study protocol is developed, including data collection procedures and questions. Second, measures for protecting human subjects have to be implemented. Third, necessary approvals are obtained [Yin15]. The preparation step also includes the identification of the case's data sources and potential

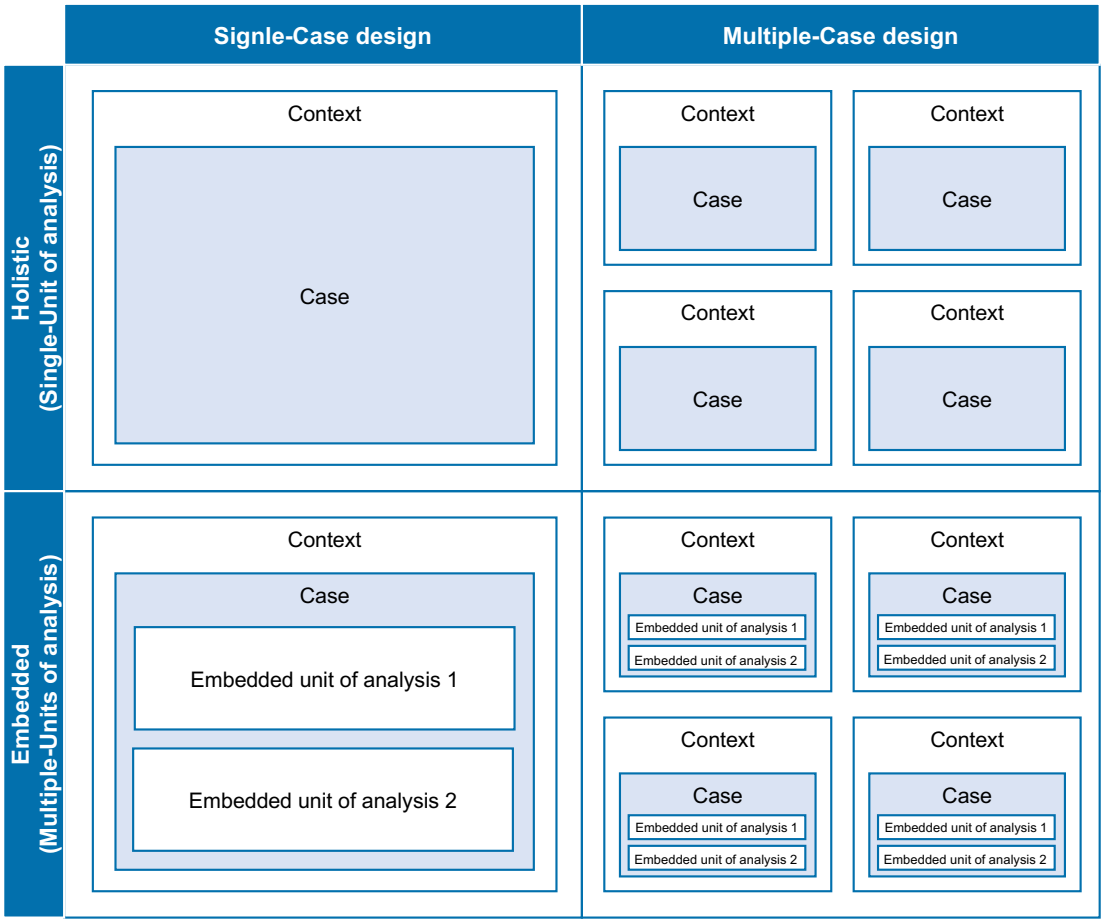

Figure 3.4.: Types of case study designs [Yin15]

embedded unit(s) of analysis, as well as planning of the data collection [Yin15]. As a part of this, the researcher must decide on appropriate data sources to draw upon.

- **Collect:**
  The purpose of the data collection step is to gather information from available sources. Possible data sources are documents, archival records, interviews, direct observation, participant observation, and physical artifacts [Sta95, Yin15]. Yin presents four principles of data collection: (1) to use multiple sources of evidence, (2) to create a case study database, (3) to maintain a chain of evidence, and (4) to use data from electronic sources carefully. Regarding the second principle, the case study database includes all relevant data materials collected during the case study [Yin15].

- **Analyze:**
  The data analysis phase "consists of examining, categorizing, tabulating, testing, or otherwise recombining evidence, to produce empirically based findings" [Yin15]. In order to perform this step correctly, Yin proposes four different analytic strategies: (1) relying on

theoretical propositions, (2) working your data from the "ground up.", (3) developing a case description, and (4) examining plausible rival explanations. The second strategy represents the opposite of the first strategy. Concepts or insights are generated by analyzing the data and identifying patterns. The third strategy seeks to structure the case using a descriptive framework. The last strategy, which works in conjunction with the previous three strategies, attempts to identify and test possible rival theories.

- **Share:**
  The sharing step of case study research deals with the distribution of the results and conclusions from the case studies [Yin15]. This includes the identification of an interested audience for the report and its format. Every case study report should include an extensive description of the case study, making it possible for the reader to immerse in the investigated phenomenon. This allows the reader to better understand and interpret the results.

By conducting a holistic multiple-case design in P1, we have identified the motivation and benefits of enterprise architects in two different interorganizational EAM initiatives. In P2 and P3, we used a holistic multiple-case design to create an understanding of the use of business capabilities in a horizontal interorganizational context. Whereas in P4, we applied a holistic multiple-case study to bring the process of interorganizational BCM development to light.

Part B

1. Why would Enterprise Architects work together? - A Multiple Case Study

Table 3.2. Fact sheet embedded publication P1

Authors	Yılmaz, Fatih*†
	Akdemir, Duygu*
	Matthes, Florian*
	*Technische Universität München,
	Chair of Software Engineering for Business Information Systems,
	Boltzmannstraße 3,
	85748 Garching, Germany
	† Institut für Rundfunktechnik GmbH,
	Floriansmühlstraße 60,
	80939 München, Germany
Outlet	26th Americas Conference on Information Systems (AMCIS)
Status	Published
Contribution of first author	Problem definition, research design, case study identification, data analysis, interpretation, reporting

Abstract. In recent years, organizations are continuously confronted with the loss of market shares by competitors introducing new technologies and innovative business models. Instead of competing with these companies, organizations increasingly cooperate with competitors from the same industry. They are shifting from competition to cooperation to gain benefits by exchanging knowledge and identifying synergy potential. As cooperating organizations are usually connected regarding their processes and IT, the significance of inter-organizational enterprise architecture (EA) is increasing. However, often companies are not willing to share their internal EA knowledge and resources with others. This research is motivated by the lack of empirical studies on the collaboration between enterprise architects. Based on the result of 13 semi-structured interviews in two case studies, we present the motivation, aims, and benefits of enterprise architects in inter-organizational collaborations with others.

2. Interorganizational Business Capability Maps: Use Cases for Horizontal Collaboration

Table 3.3. Fact sheet embedded publication P2

Authors	Yılmaz, Fatih*†
	Schmidt, Oliver*
	Matthes, Florian*
	*Technische Universität München,
	Chair of Software Engineering for Business Information Systems,
	Boltzmannstraße 3,
	85748 Garching, Germany
	† Institut für Rundfunktechnik GmbH,
	Floriansmühlstraße 60,
	80939 München, Germany
Outlet	27th Americas Conference on Information Systems (AMCIS)
Status	Published
Contribution of first author	Problem definition, research design, case study identification, data analysis, interpretation, reporting

Abstract. Nowadays, organizations are under the pressure of changing business environments, including continuously changing customer needs and technological innovations. In order to remain competitive, they are increasingly engaging in collaborations with their customers, suppliers, and competitors. Enterprise architecture management (EAM) and business capabilities can help to monitor the complexity of such an endeavor by illustrating the alignment of business and IT beyond the company's boundaries. Our research is motivated by the lack of empirical studies on use cases of collaboratively developed business capabilities. By conducting a multiple case study, we present 19 use cases for interorganizational business capability maps (BCM) in horizontally collaborating organizations. Further, we map these to common challenges in interorganizational enterprise architecture (EA) collaborations, which we identified in the literature and evaluated in case studies.

3. Application of Interorganizational Business Capability Maps in Different Forms of Horizontal Enterprise Architecture Collaboration

Table 3.4. Fact sheet embedded publication P3

Authors	Yılmaz, Fatih*†
	Matthes, Florian*
	*Technische Universität München,
	Chair of Software Engineering for Business Information Systems,
	Boltzmannstraße 3,
	85748 Garching, Germany
	† Institut für Rundfunktechnik GmbH,
	Floriansmühlstraße 60,
	80939 München, Germany
Outlet	23rd IEEE Conference on Business Informatics (CBI)
Status	Published
Contribution of first author	Problem definition, research design, data collection, data analysis, interpretation, reporting

Abstract. In today's business environment, organizations are continuously confronted with increasing dynamics in the market by competitors introducing new business models or using disruptive technologies to gain advantage. To remain competitive, practitioners and scientists have recognized the relevance of collaboration between organizations in terms of business but also in terms of IT. Centralized top-down enterprise architecture management (EAM) methods have to be adapted in order to support this trend. But empirical studies investigating the introduction and use of interorganizational enterprise architecture (EA) artifacts in this context are still rare. Therefore, we conducted a multiple case study of six EA collaboration initiatives using interorganizational business capability maps (BCM). Based on the results of 12 semi-structured interviews, we categorize and present the goals and use cases in two different forms of horizontal EA collaboration.

4. Deriving a Process for Interorganizational Business Capability Modeling through Case Study Analysis

Table 3.5. Fact sheet embedded publication P4

Authors	Yılmaz, Fatih*†
	Feldmeier, Julian*
	Matthes, Florian*
	*Technische Universität München,
	Chair of Software Engineering for Business Information Systems,
	Boltzmannstraße 3,
	85748 Garching, Germany
	† Institut für Rundfunktechnik GmbH,
	Floriansmühlstraße 60,
	80939 München, Germany
Outlet	23rd International Conference on Enterprise Information Systems (ICEIS)
Status	Published
Contribution of first author	Problem definition, research design, case study identification, data collection, data analysis, interpretation, reporting

Abstract. To stay competitive in a globalized, constantly changing market environment with ongoing technological advancements, companies are not only focusing on their organization's key capabilities but also collaborate more closely with partners, suppliers, customers, and also competitors. By analyzing an enterprise's business capabilities, business leaders get an abstracted, holistic view of the organization and the alignment of its business model and visions with the IT. Further, business capabilities and visualizations can help to improve the communication with business partners. Therefore, different companies operating in the same industry collaboratively identify and model common business capabilities to define a shared ontology. Based on the knowledge gained through literature review carried out on the topic of business capability modeling, we conducted a multiple case study in this field. As a result, we derived a reference process for interorganizational business capability modeling which we evaluated by conducting semi-structured interviews with members of different interorganizational initiatives. The outcome of our research is an iterative process of modeling business capabilities in interorganizational collaborations.

Part C

CHAPTER 4

Discussion

This chapter summarizes and discusses the key results of the publications embedded in this doctoral thesis. In total, we published four peer-reviewed papers in international scientific conferences to answer all three research questions (see Section 1.2).

Despite the increasing urge of organizations to collaborate with other enterprises driven by changing business environments, the research field of interorganizational EA remains largely unexplored [Kot17]. Inspired by this research gap, we explored the reasons for enterprise architects to collaborate across enterprises. Therefore, we defined the following research question:

Research Question 1

RQ 1: What is the motivation for enterprise architects from different organizations to work together?

To answer this research question, we conducted a systematic literature review to identify existing literature in the field of interorganizational EAM. The result of the literature review showed that the research field of cross-enterprise EAM includes related scientific work (cf. [DS14]) but is not entirely comprehensive. For example, no previous work has examined the fundamental question of the motivations for collaborating with other companies in the field of EAM. We addressed this research gap in P1.

To develop an understanding of the motivations of enterprise architects and thus answer the first research question, we conducted a multiple-case study. The case study consisted of two case studies, including 13 semi-structured interviews with architects from 11 organizations. Each case study represents one collaborative EAM initiative with horizontally collaborating organizations. However, the initiatives follow different collaboration forms, namely (1) "working group" and (2) "community of practice". Both case studies, and thus all companies interviewed, are from

the media industry. Each interviewee was asked about the driving factors, goals, and expected benefits of collaboration.

The findings show that enterprise architects of both collaboration forms follow different motivations for collaboration. This results from the two mainly different cooperation settings with varying objectives for collaboration. In a "working group" with related organizations, the top IT management of each company can act as principal for joint EAM initiatives. In contrast, a "community of practice" consists of enterprise architects and, thus, organizations voluntarily participating in the exchange with others. The community can also be initiated by individual employees. The remaining participants are architects who share the common interest of the initiating person or organization. While the participants of the "working group" are mainly driven by the opportunity to reveal IT cost-saving opportunities, is the "community of practice" merely oriented towards the joint creation of an industry-wide EA reference model. The "working group" is also developing a reference model, but unlike the "community of practice", it will be used as a tool to promote transparency and comparability among companies and discover prospective collaboration projects. This objective is more important for the "working group" than for the "community of practice".

The respondents in both case studies stated they would benefit from the collaboration. The exchange of personal and professional experiences is a major benefit for the participants of the "working group". By presenting and testing new concepts, they can learn and benefit from the capabilities of the entire "working group". The participants of the "community of practice" perceive the overall higher quality of results as an advantage of their joint work. In general, the development of new concepts with other architects, who may not always share the same opinion, is a decisive advantage. Away from the daily work routine, this exchange and discussion promote the creative spirit of the participants in both forms of collaboration.

The second research question of the thesis is concerned with the use of the BCM in horizontal collaborations:

Research Question 2

RQ 2: What are the use cases for a business capability map in horizontal interorganizational EA collaboration?

As a widely used EA artifact in practice, it has become the subject of scientific investigation in the field of IS research (cf. [AKHV+18]). However, its use across organizations has only been superficially studied so far (cf. [BBR14]).

Organizations that collaborate with other organizations face unavoidable challenges due to the collaboration setting. Hence, one component of this research question was to evaluate the map as a tool to address typical challenges in horizontal partnerships. To this end, we first conducted an extensive systematic literature review to synthesize these challenges collected in the existing literature. The review revealed a comprehensive list of 32 challenges, which were prioritized and reduced to 15 challenges based on the number of sources. These challenges served as the foundation for a subsequent review by interorganizational EA experts. A list of typical challenges organizations face when engaging in horizontal interorganizational EAM collaborations is summarized in Figure 4.1.

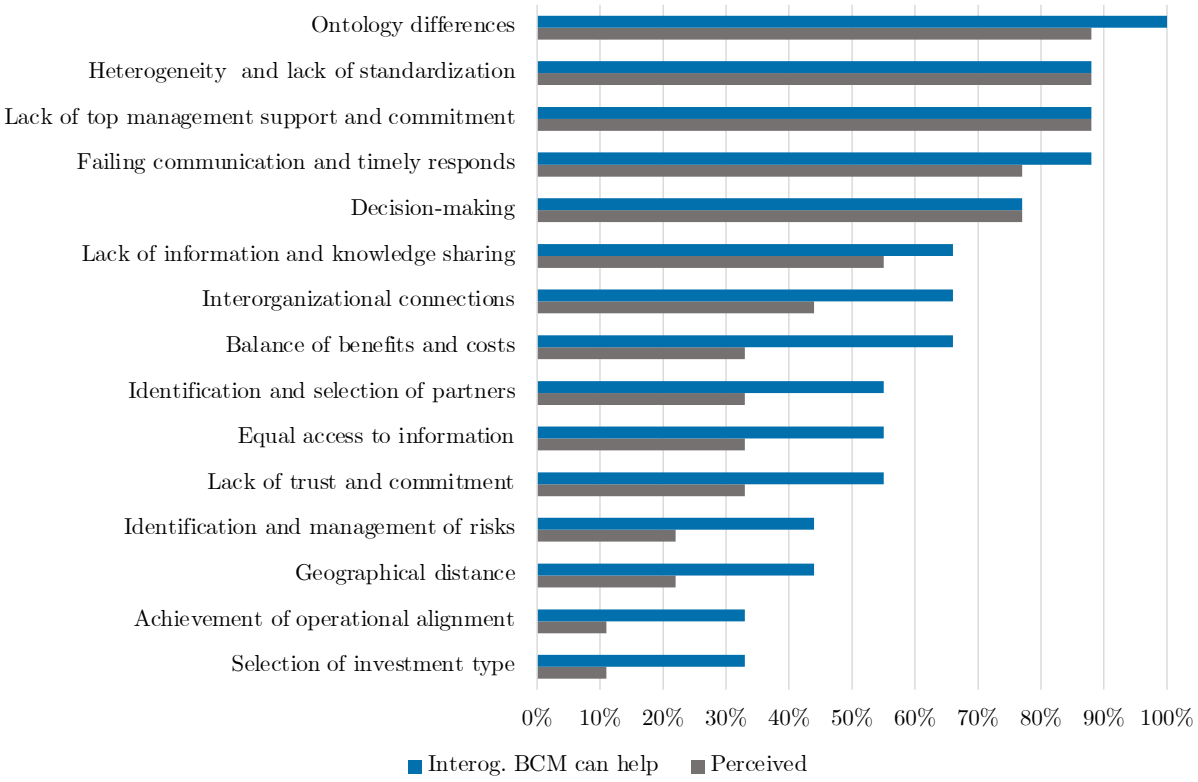

Figure 4.1.: Perceived and addressed challenges in horizontal interorganizational collaborations [YSM21]

The challenge of "lack of information and knowledge sharing" can be traced back to 23 sources (cf. [MSS+13, MGS05]), making it the most common challenge in horizontal collaborations in the literature. More than half of our interviewees could also confirm this challenge in their environment. The second most common challenge we could find in 15 publications is "lack of trust and commitment" (cf. [AP10, PK08]). This challenge was confirmed by one-third of the experts, which is a sign of above-average transparency and trust between the collaborating companies. However, this is understandable since organizations want to be involved in EAM collaborations with other companies. The remaining challenges appeared between two and eight times in the literature. The most difficulties perceived by the interviewees in their collaboration are "ontology differences", "heterogeneity and lack of standardization", and "lack of top management support and commitment". Ontology differences describe impeded communications by the lack of a rigorous and formal definition of jointly aligned models and languages [AP10, DS14]. Expectedly, all interviewed experts unanimously believed that this challenge could be solved by utilizing a uniform BCM. By establishing and ambiguously defining business capabilities, precisely this challenge is addressed. The heterogeneity and lack of standards in both IT and business processes further complicate collaboration [MP14]. A large number of experts are convinced that this challenge could be reduced by using a joint BCM as a framework. The third most often mentioned challenge in literature is the "lack of management support" in collaboration projects.

Even though this challenge was mentioned in only three publications (cf. [AP10]), it is one of the biggest challenges in EAM collaborations. Since the map is already often used in individual companies as a communication tool with management, it stands to reason that the experts surveyed also see the tool as helpful in horizontal collaborations. The remaining challenges were described in detail in publication P2. The majority of interviewees perceive social issues, such as ontology and communication differences, as well as architectural issues, such as a lack of standardization. However, they see significant potential in interorganizational BCM as a tool for addressing these challenges.

The semi-structured interviews conducted as part of the multiple-case study confirmed that the BCM is a promising tool to address typical challenges in horizontal collaborations [YSM21]. In the next step, we investigated the application of the BCM in an interorgaizational context. For this purpose, we collected and presented the concrete use cases of BCM in two publications (P2 and P3). After conducting an online survey among various enterprise architects, we could develop five categories of use cases: (1) strategy and business model mapping, (2) organizational mapping, (3) project mapping, (4) application portfolio mapping, and (5) general use cases. In a total of six case studies, we interviewed 17 EA experts from different industries to identify concrete use cases for each category. Further, we had the opportunity to participate in selected cross-company EA initiatives. Through these observations, we were able to confirm the mentioned use cases and thus develop a deeper understanding.

After creating a list of actual and potential use cases in P2, we extended the list of use cases with additional case studies in P3. Further, we mapped the use cases to each one of the collaboration forms based on the outcome of P1 that each collaboration form follows distinct collaboration goals. Table 4.1 summarizes the aims and use cases of interorganizational BCM in horizontal collaborations in "working groups".

A "working group" pursues each aim we have identified in the case studies. This might be because the "working group" has certain directives from the IT management that it needs to follow. As a result, they pursue a diverse set of objectives. Just like the collaboration goals, nearly all use cases identified during the case studies are relevant for a "working group". Exceptions are the use of the BCM for benchmarking purposes and to visualize the distribution of used cloud technologies.

In contrast, participants of the "community of practice" follow distinct objectives in their collaboration. On the one hand, they are interested in exchanging general information and expertise among enterprise architects from multiple companies. On the other hand, they are deeply committed to the development of industry-wide reference models. Compared to "working groups", "communities of practice" utilize much fewer use cases. The BCM is primarily used to establish a common language. In some cases, the BCM is used as a tool to perform anonymized benchmarks among the participating organizations. Because the benchmark results are only shared with members of the "community of practice", it also serves to encourage additional organizations to join the initiative. An overview of the relevant use cases for a "community of practice" is illustrated in Table 4.2.

Publications P1, P2, and P3 have served to identify and categorize the use cases of a BCM in a horizontal cross-enterprise context and to assign them to collaboration forms with their

Table 4.1. Collaboration aims and relevant use cases in a "working group" [YM21]

Supply chain direction	EA collaboration form	EA collaboration aim	Interorganizational BCM use case
Horizontal	Working group	Identification of cost-saving opportunities	Strategy and business model mapping
			Business model understanding and development
		Ensure comparability and adaptability	Organizational mapping
			Organizational structure clarification for mergers and acquisitions
		Improvement of own developed concepts	Project mapping
			Project information and outcome
		Identification and support of cooperation projects	Application portfolio mapping
			Application landscape harmonization
			Application development
			Application procurement
			Visualization of cloud candidates
			Communication of application and technology standards
	Community of practice	Establishment of an industry-wide reference model	General use cases
			Language and vocabulary unification
		Establishment of a common EAM methodology	Benchmarking tool
			Management communication tool
		Development of a common application landscape	Monitoring the impact of new regulations on business and IT
		Encourage exchange and communication between organizations	

Table 4.2. Collaboration aims and relevant use cases in a "community of practice" [YM21]

Supply chain direction	EA collaboration form	EA collaboration aim	Interorganizational BCM use case
Horizontal	Working group	Identification of cost-saving opportunities	Strategy and business model mapping
			Business model understanding and development
		Ensure comparability and adaptability	Organizational mapping
			Organizational structure clarification for mergers and acquisitions
		Improvement of own developed concepts	Project mapping
			Project information and outcome
		Identification and support of cooperation projects	Application portfolio mapping
			Application landscape harmonization
			Application development
			Application procurement
			Visualization of cloud candidates
			Communication of application and technology standards
	Community of practice	Establishment of an industry-wide reference model	General use cases
			Language and vocabulary unification
		Establishment of a common EAM methodology	Benchmarking tool
			Management communication tool
		Development of a common application landscape	Monitoring the impact of new regulations on business and IT
		Encourage exchange and communication between organizations	

responding goals. We have also shown that the map can address typical challenges that arise in horizontal collaborations. In the next step, we explored the collective definition of shared capabilities and the creation of the map (P4). In this process, we answered the following research question:

Research Question 3

RQ 3: How should horizontally cooperating organizations proceed in jointly modeling a business capability map?

Due to the fact that the use of the map is already widespread in individual organizations, there is also a considerable amount of research on the process of creating a BCM [BBH07, ZSHG13, EGH+15]. However, no research exists in the interorganizational context. We have filled this gap by presenting a reference process for how companies should design a common BCM (see Figure 4.2).

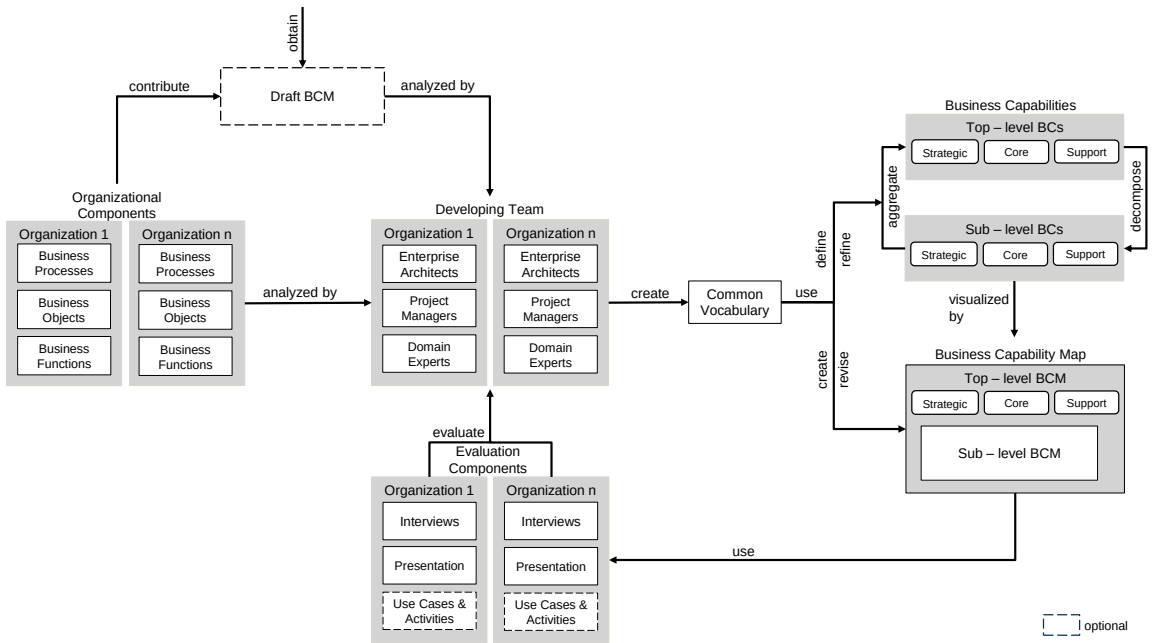

Figure 4.2.: Process of interorganizational business capability modeling [YFM21]

During our study, we notices that meetings where business capabilities are jointly defined can take place either on-site or virtually. Driven by the geographic distance between participants, we mostly observed virtual meetings. Establishing business capabilities and defining them requires intensive communication and discussion among participants. Therefore, the introduction of a coordinating and facilitating role for this endeavor is beneficial. This person is usually also responsible for planning the meetings. The frequency of meetings ranges from every two weeks to once a month.

A draft business capability model is used in each case study at the initial phase. This allowed

the team to improve their understanding of the expected outcome, use the BCM as a guideline or as a starting point for their own BCM. This draft model is either provided by one of the participants or is acquired externally. This step makes it possible to build on existing models and thus shorten the time needed to create the map. However, it is not absolutely necessary but optional.

The modeling should begin with the definition of general business capabilities before starting to add granularity by modeling lower-level capabilities. Even though this approach is widespread in individual organizations, it makes particular sense in a cross-company context. In a conglomerate of multiple enterprise architects, it is more efficient to define higher-level capabilities than lower-level capabilities that may vary from company to company. In the next step, the top-level capabilities can be broken down into more fine-grained capabilities. Discussions are facilitated and led by the facilitator until a consensus is reached among the group and the business capability is eventually defined. Consisting of the capability's name and its description, a shared glossary is created and refined during the modeling process. If the group consists of international organizations, with participants speaking different languages, the group has to agree on a language in which the capabilities are recorded.

Similar to the modeling process in single organizations [EGH+15, BBH07, ZSHG13], the business capabilities are defined by analyzing the business processes of the organizations. However, the processes are only used as an anchor point to determine the capabilities. One reason for this is that companies, although they operate in the same industry, have different business processes. Second, business capabilities, by definition, describe "what" a company does [UR11], not "how". This would be consistent with the definition of business processes [LDL03, Wes19]. Strict adherence to business processes in modeling the capabilities is tempting but leads to a revision of the BCM in the later stage. Furthermore, business functions and objects serve as a basis for defining capabilities. The team ideally consists of business and IT experts. Even though the map primarily has a business focus, the participation of enterprise architects is of great importance to ensure subsequent use in the EAM context. However, no IT objects are assigned to the capabilities during the BCM creation phase. This is done during the deployment of the map.

The entire process of defining the capabilities is of iterative nature. The identified business capabilities, sub-capabilities, descriptions, and the relations of the capabilities to each other are constantly evaluated. The participants collect feedback from various stakeholders in their companies by presenting the current state of the BCM. Based on the feedback, the capabilities can be renamed, further decomposed, or aggregated into higher-level capabilities. This step is conducted until a consensus is reached among the developing team. Changes in the later stage are possible and can be requested by the participants, but due to the stability of BCMs, significant adjustments are not expected on a regular basis.

This reference process allows us to answer RQ3 by providing guidance on how horizontally collaborating organizations should define and model a common BCM.

CHAPTER 5

Implications

The results of this doctoral thesis have implications for both research and practice. In the following two sections, we will present our contributions related to each of the three research questions. First, we will present the results that have expanded the body of knowledge in this research field and thus can be helpful for other researchers in their investigations. Secondly, we discuss our contribution to practice by presenting possible implementations of the findings by practitioners.

5.1. Implications for Research

- **Related to RQ1:**
  EA and EAM is a field of research that has been intensively addressed and explored in recent years [AKMB17, Kot17]. Consequently, a wide range of literature and research results exist in scientific databases. However, according to the results of our literature review, the same does not apply to the cross-enterprise use of EAM. There is limited research that examines EAM across company boundaries [Tam17]. By identifying the motivation, reason, and benefits for enterprise architects to collaborate with other architects from different companies, we provide a better understanding for other researchers interested in this field. Further, we emphasize the relevance of EAM and motivate further investigations in an interorganizational context.
- **Related to RQ2:**
  Horizontal collaboration is not a new phenomenon and has been researched for several years [SS02]. Thus, many papers also exist that examine the challenges associated with such collaboration [AP10, PK08, MP14]. We have placed these challenges in the EAM context for the first time and summarized them as the result of an extensive structured

literature review. We were also able to confirm the identified challenges in practice by conducting interviews. For researchers, this is doubly important. First, they can now find an aggregated overview of the challenges. Second, the challenges were confirmed in practice and ranked according to their relevance. Researchers can use these findings and develop further solutions to address these challenges. The use cases of the map were also systematically studied and compiled for the first time in research. They add to the existing knowledge on the use of BCMs and serve researchers as a basis for further investigations in individual companies or collaborations.

- **Related to RQ3:**
  The definition of business capabilities and the modeling of BCMs in individual companies have been studied extensively by scholars [BBH07, EGH+15, ZSHG13]. However, the development in collaboration with other companies has not been subject to research. We have filled this gap by presenting a reference process for creating BCMs in horizontal collaborations. In addition, we have highlighted the differences with the approach in individual companies. This helps researchers in the EAM field to understand the differences and similarities of development methods in collaborations and single companies. Consequently, the results of our research contribute to the expansion of knowledge in the field of business capability modeling.

5.2. Implications for Practice

- **Related to RQ1:**
  Besides implications for research, the results of this doctoral thesis have multiple implications for practice. Due to a lack of experience and because interorganisational EAM activities are not widespread in practice, companies are very reluctant to collaborate with other organizations in terms of EAM. Even if enterprise architects would be interested in exchanging and participating in "working groups", the management would first have to agree to a collaboration as the circumstances require. As part of the first research question, we elaborated on the expected benefits of cross-company collaboration between enterprise architects. This list of benefits can help architects justify their intent to collaborate and thus participate in an exchange. In addition, the reasons and driving forces for collaboration identified in P1 can motivate further organizations and enterprise architects to collaborate.
- **Related to RQ2:**
  Companies entering into horizontal collaborations face a variety of challenges. Some of them are ontology differences [AP10], heterogeneous business processes and IT landscapes [MP14]. We verified the existence of these challenges in horizontal collaborations in practice and were able to confirm them. As a tool that can address these challenges, we presented the BCM. This allows practitioners who are also facing one or more of these challenges to utilizing the map. Moreover, the relationship we established between the challenges and benefits of the BCM can serve as motivation for further companies to use the map. After deciding to adopt the BCM, the companies having potentially no experi-

ence with the interorganizational application of the BCM, can choose and select targeted use cases based on the collaboration form they enter into and the collaboration aims.

- **Related to RQ3:**
  Primarily, companies developing an interorganizational BCM for the first time can benefit from the reference process presented in P4. From this process, they can glean what information they need to define joint business capabilities. They will also find a list of roles to involve, different approaches to modeling the capabilities, as well as evaluating and finalizing the BCM. But also companies and architects who have already gained experience with the definition and creation of a BCM can use the reference process to improve their approach of development.

CHAPTER 6

Limitations

This doctoral thesis and the embedded publications are subject to several limitations. In this chapter, we discuss the major limitations according to the four main types of validity of research studies: internal validity, external validity, construct validity, and reliability [Yin15, Bha12, RH09]. We briefly delineate each of these types of validity, discuss how they could potentially affect the results of this thesis, and describe how we have addressed them. Table 6.1 summarizes the potential threats to validity in each publication.

- **Internal validity** is concerned with the causal relationship between the observed variables and the results of the study [Bha12]. It includes mainly threats for explanatory case studies when the researcher is interested in explaining the dependencies of events [Yin15]. Since "this logic is inapplicable to descriptive or exploratory studies [...], which are not concerned with this kind of causal situation" [Yin15], we ignored this threat in P1, P2, and P4. In P3, we mapped the results of P1 to the findings in P2 and extended them. This process may involve biased mapping of the researcher. We counteracted this limitation by taking the characteristics of the observed case studies into account and matching them, e.g., based on the collaboration forms.
- **External validity** examines to what extent the study results can be generalized from the observations to the population, other people, organizations, contexts, or time [Bha12]. For structured literature reviews in P1, P2, and P4, external validity is concerned with the selection of relevant publications to the research question [ESSD08]. In order to avoid this threat and ensure the inclusion of representative papers, we followed guidelines and best practices for systematic literature review [WW02, VBSN$^+$09]. Being the first study we conducted as part of this thesis, the number of case studies in P1 is limited. Further, the interviewees, and thus the organizations in which they work, are exclusively located in the media industry. The external validity of the presented use cases in P2 and P3 might

Table 6.1. Summary of potential validity threats

Paper	Internal validity	External validity	Construct validity	Conclusion validity
P1	-	- Selection of irrelevant papers - Media industry sample - Limited number of case studies	- Missing relevant papers - Improper design of interview guideline	- Misleading data extraction - Incorrect conclusions
P2	-	- Selection of irrelevant papers - Not generalizable use cases	- Missing relevant papers - Improper design of survey and interview guideline	- Misleading data extraction - Incorrect conclusions
P3	Subjective data napping	Not generalizable use cases	Improper design of interview guideline	Incorrect conclusions
P4	-	- Selection of irrelevant papers - Not generalizable process	- Missing relevant papers - Improper design of interview guideline	- Misleading data extraction - Incorrect conclusions

be threatened by the generalizability of the use cases for horizontal collaborations. We mitigate this risk by interviewing 17 EA experts from 12 companies and four different industries. This allowed us to continuously evaluate the use cases. We included organizations from five countries in the case studies to avoid geographic and cultural bias. Similar countermeasures were taken to mitigate threats to external validity in P4. We assessed the presented process by collecting feedback from six EA experts from three interorganizational EA initiatives. Finally, we would like to note that our research is only applicable to horizontal collaborations. Thus, the results presented are not transferable to vertical and diagonal forms of cooperation.

- **Construct validity** examines to what extent the study's measures represent the intended construct the researcher had in mind [Bha12, RH09]. As one component of the publications P1, P2, and P4, we conducted structured literature reviews. This research method is threatened by the incompleteness of relevant literature [ESSD08]. To avoid this threat, we conducted the literature review in several electronic databases with a focus on IS research outlets (e.g. Digital Library of the Association for Computing Machinery (ACM)) but also databases providing results from other research fields (e.g. Scopus). In each of the publications, we conducted semi-structured interviews. Construct validity concerns the improper design of the interview guideline. Thus, the guidelines were designed and tested

by involving multiple researchers. To ensure construct validity in survey research, the questionnaire has to be designed adequately. We improved construct validity of the surveys by involving multiple researchers, similar to the design of the interview guidelines.

- **Reliability** reflects to what degree "the data and the analysis are dependent on the specific researchers" [RH09]. When conducting literature reviews in P1, P2, and P4, we tried to minimize this threat by following typical guidelines for structured literature reviews [WW02, VBSN+09]. In case study research, a later researcher has to be able to follow the same procedures as described and conduct the same case study [Yin15]. To avoid incorrect conclusions and ensure transparency and replicability of the results, we have created a case study database including interview guidelines, audio recordings, and interview protocols.

CHAPTER 7

Future Research

This dissertation provides valuable contributions to application scenarios and the development of BCM in horizontal collaborations. However, it also reveals new research gaps and, thus, new opportunities for researchers to further expand the body of knowledge in this field. This chapter gives a brief overview of four topics that are worthwhile for follow-up studies.

Despite our efforts and the multitude of case studies, we cannot ensure the completeness of the presented use cases. Certainly, this list can be extended by conducting additional case studies and interviews with experts from other industries and countries. But we would particularly like to point out the following four research suggestions that can expand the field of interorganizational EAM:

- **Investigations in vertical and diagonal collaborations:**
  Since business capabilities are fundamental to a company's ability to conduct business, they are stable and rarely change [UR11]. Further, they describe "what" an organization does, not "how" [UR11]. These two characteristics clearly distinguish business capabilities from business processes. In contrast to business capabilities, a business process "implies a strong emphasis on "how" work is done within an organization" [Dav93]. During our research, we observed that the business processes of even horizontally cooperating companies might differ. However, business capabilities are similar or even the same. Consequently, we limited our research to horizontal collaborations. Nevertheless, an application of BCM is also conceivable and possible in vertical collaborations. In the survey we conducted on the purpose of BCM, some EA experts indicated that they use a joint BCM for vertical collaborations with their suppliers or customers. However, since these have entirely different business capabilities, agreeing on a shared BCM would be very costly and the resulting map extensive. But the results of the survey showed that BCMs are also used in practice in vertical collaborations. This motivated further research avenues related to pos-

sible application scenarios in vertical and diagonal collaborations. Moreover, it suggests to investigate the modeling process in these collaboration directions.

- **Evaluation of appropriate visualizations for each use case:**
  Visualizations of business capabilities have been investigated by several researchers in the IS field [AKHV+18, KLFK10, UR11]. The investigations range from the simple representation of the business capabilities based on a map [KLFK10] to concrete illustrations of the individual use cases [AKHV+18]. In our research, we have disregarded the examination of possible visualizations of both the BCM and the use cases. Since the basic structure of the BCM hardly differs from the BCM used in a single organization, the potential for further research here is limited. However, the interorganizational use cases vary significantly from those of a single company. Therefore, we would like to encourage further research into the visualization possibilities of individual use cases.

- **Ideal team size for BCM modeling:**
  The people involved in the development play an essential role in modeling business capabilities and the BCM. This undertaking ideally starts with a draft BCM and a list of different business processes or functions of the respective companies. Based on this input, a team consisting of diverse roles develops the map. This process is primarily communicative and involves countless discussions and iterative loops. As the number of team members increases, the number of communication increases. This might slow down the development process. However, on the other side, a potentially more complete and mature result is expected. This raises the question of the "sweet spot" of the team constellation and motivates further research.

- **Creation of a comprehensive interorganizational EAM framework:**
  In this dissertation, we predominantly studied the use and development of an interorganizational BCM. However, the first research question and the first publication (P1) addressed the topic of cross-company EAM in general by asking architects about their motivations for collaborating with other architects. The remaining publications have a clear focus on BCM as a collaboration tool. However, business capabilities are only one component of EAM in that they support the "Business & Organization" layer as an artifact [Buc11]. Consequently, the interorganizational EAM field still offers several open questions, especially in the remaining layers and the cross-cutting areas [Buc11].

CHAPTER 8

Conclusion

The relationship between organizations changes fundamentally from being competitors to increased coevolution with customers, suppliers, competitors, and other complementing organizations [Moo96, Bar04]. They adapt to their surroundings and act as a part of an ecosystem [Moo96]. This development also affects the IT landscape of the organizations and thus increases the need to adapt the communicating systems to each other [DS14]. This raises the relevance of interorganizational EAM both in research and practice (cf. [MSS+13]). However, specific motivations for architects to collaborate across organizational boundaries have remained unexplored. We have filled this gap by collecting the motivations, reasons, and expected benefits of collaboration. Furthermore, we identified and confirmed typical challenges in horizontal collaborations and evaluated the BCM as a suitable communication tool in an interorganizational EAM environment. By identifying concrete use cases and presenting a reference process for modeling of business capabilities, we have created literature for organizations that would also like to adopt the BCM in their collaborations. Consequently, this dissertation allowed us to successfully expand the body of knowledge in the research field of interorganizational EAM with a focus on horizontal collaborations.

Bibliography

[AEE+09] Rainer von Ammon, Thomas Ertlmaier, Opher Etzion, Alexander Kofman, and Thomas Paulus. Integrating complex events for collaborating and dynamically changing business processes. In *Service-Oriented Computing. ICSOC/ServiceWave 2009 Workshops*, pages 370–384. Springer, 2009.

[AIVH+15] Adina Aldea, Maria Eugenia Iacob, Jos Van Hillegersberg, Dick Quartel, and Henry Franken. Capability-based planning with archimate - linking motivation to implementation. In *Proceedings of the 17th International Conference on Enterprise Information Systems (ICEIS)*, pages 352–359. INSTICC, SciTePress, 2015.

[AKHV+18] Pouya Aleatrati Khosroshahi, Matheus Hauder, Stefan Volkert, Florian Matthes, and Martin Gernegroß. Business capability maps: Current practices and use cases for enterprise architecture management. In *Proceedings of the 51st Hawaii International Conference on System Sciences (HICSS)*, pages 4603–4612, Honolulu, HI, USA, 2018. ScholarSpace.

[AKMB17] Hamood Al-Kharusi, Suraya Miskon, and Mahadi Bahari. Research perspective in enterprise architecture. In *Proceedings of the 21st Pacific Asia Conference on Information Systems (PACIS)*, Langkawi Island, Malaysia, 2017. AIS.

[AP10] Mohammad Alawamleh and Keith Popplewell. Risk sources identification in virtual organisation. In *Enterprise Interoperability IV - Making the Internet of the Future for the Future of Enterprise*, pages 265–277. Springer London, London, UK, 2010.

[ARW08] Stephan Aier, Christian Riege, and Robert Winter. Unternehmensarchitektur–literaturüberblick und stand der praxis. *Wirtschaftsinformatik*, 50(4):292–304, 2008.

[ASML12] Frederik Ahlemann, Eric Stettiner, Marcus Messerschmidt, and Christine Legner. *Strategic enterprise architecture management: challenges, best practices, and future developments*. Springer Berlin Heidelberg, Berlin, Heidelberg, Germany, 2012.

[Bab73] Earl Robert Babbie. *Survey research methods*. Wadsworth Publishing Company, Belmont, CA, United States, 1973.

[BAB+11] Christoph Becker, Gonçalo Antunes, José Barateiro, Ricardo Vieira, and José Borbinha. Modeling digital preservation capabilities in enterprise architecture. In *Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times*, pages 84–93, College Park, MD, USA, 2011. ACM.

[Bak00] Michael Baker. Writing a literature review. *The Marketing Review (TMR)*, 1(2):219–247, 2000.

[Bar91] Jay Barney. Firm resources and sustained competitive advantage. *Journal of management (JOM)*, 17(1):99–120, 1991.

[Bar04] Mark Barratt. Understanding the meaning of collaboration in the supply chain. *Supply Chain Management*, 9(1):30–42, 2004.

[BBF+19] Gloria Bondel, Duc Huy Bui, Anne Faber, Dennis Seidel, and Matheus Hauder. Towards a process and tool support for collaborative api proposal management. In *Proceedings of the 25th Americas Conference on Information Systems (AMCIS)*, Cancun, Mexico, 2019. AIS.

[BBG+15] Solvita Bērziša, George Bravos, Tania Cardona Gonzalez, Ulrich Czubayko, Sergio España, Jānis Grabis, Martin Henkel, Lauma Jokste, Jânis Kampars, Hasan Koç, et al. Capability driven development: an approach to designing digital enterprises. *Business & Information Systems Engineering*, 57(1):15–25, 2015.

[BBH07] Jean-Pierre Brits, Gerrit Botha, and Marlien Herselman. Conceptual framework for modeling business capabilities. In *Proceedings of the Informing Science and IT Education Joint Conference (InSITE)*, pages 151–170, 2007.

[BBL12] Stefan Bente, Uwe Bombosch, and Shailendra Langade. *Collaborative enterprise architecture: enriching EA with lean, agile, and enterprise 2.0 practices.* Morgan Kaufmann Publishers Inc., San Francisco, CA, United States, 2012.

[BBR14] Adel Bakhtiyari, Alistair Barros, and Nick Russell. Enterprise architecture for business networks: A constructivist synthesis. In *Proceedings of the 25th Australasian Conference on Information Systems (ACIS)*, Auckland, New Zealand, 2014. AIS.

[BCC+98] David Boddy, Caitlin Cahill, Marilyn Charles, Heidi Fraser-Kraus, and Douglas Macbeth. Success and failure in implementing supply chain partnering: an empirical study. *European Journal of Purchasing & Supply Management*, 4(2-3):143–151, 1998.

[BDE+13] Ruth Breu, Schahram Dustdar, Johann Eder, Christian Huemer, Gerti Kappel, Julius Köpke, Philip Langer, Jürgen Mangler, Jan Mendling, Gustaf Neumann, et al. Towards living inter-organizational processes. In *Proceedings of the 15th Conference on Business Informatics (CBI)*, pages 363–366, Geneva, Switzerland, 2013. IEEE.

[BFM18] Gloria Bondel, Anne Faber, and Florian Matthes. Reporting from the implementation of a business capability map as business-it alignment tool. In *Proceedings of the 22nd International Enterprise Distributed Object Computing Workshop (EDOCW)*, pages 125–134, Stockholm, Sweden, 2018. IEEE.

[BGM87] Izak Benbasat, David Goldstein, and Melissa Mead. The case research strategy in studies of information systems. *MIS Quarterly (MISQ)*, pages 369–386, 1987.

[Bha12] Anol Bhattacherjee. *Social Science Research: Principles, Methods, and Practices*. CreateSpace, Scotts Valley, CA, USA, 2012.

[BHK93] Willem P. Burgers, Charles W. L. Hill, and W. Chan Kim. A theory of global strategic alliances: The case of the global auto industry. *Strategic Management Journal*, 14(6):419–432, 1993.

[BK99] Maria Bengtsson and Sören Kock. Cooperation and competition in relationships between competitors in business networks. *Journal of business & industrial marketing*, 14(3):178–194, 1999.

[Blo80] Hans Blohm. *Handwörterbuch der Organisation*. C. E. Poeschel Verlag Stuttgart, Stuttgart, Germany, 1980.

[BMH05] Daniel Beimborn, Sebastian F Martin, and Ulrich Homann. Capability-oriented modeling of the firm. In *Proceedings of the IPSI Conference*, Amalfi, Italy, 2005. IPSI BgD.

[Boe86] Joachim Boehme. *Innovationsförderung durch Kooperation: Zwischenbetriebliche Zusammenarbeit als Instrument des Innovationsmanagements in kleinen und mittleren Unternehmen bei Einführung der Mikroelektronik in Produkte und Verfahren*. E. Schmidt, Berlin, Germany, 1986.

[Bry12] Alan Bryman. *Social Research Methods*. Oxford University Press, Oxford, UK, 2012.

[Buc11] Sabine Buckl. *Developing Organization-Specific Enterprise Architecture Management Functions Using a Method Base*. Dissertation, Technical University of Munich, Munich, Germany, 2011.

[CC18] John Creswell and David Creswell. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE, Thousand Oaks, CA, USA, 2018.

[CCG01] Ricardo Chalmeta, Christina Campos, and Reyes Grangel. References architectures for enterprise integration. *Journal of Systems and Software*, 57(3):175–191, 2001.

[CDF07] Frans Cruijssen, Wout Dullaert, and Hein Fleuren. Horizontal cooperation in transport and logistics: a literature review. *Transportation journal*, 46(3):22–39, 2007.

[CMA08] Luis M. Camarinha-Matos and Hamideh Afsarmanesh. *Collaborative networks: Reference modeling*. Springer, New York, NY, USA, 2008.

[Coo88] Harris Cooper. Organizing knowledge syntheses: A taxonomy of literature reviews. *Knowledge in Society*, 1(1):104–126, 1988.

[CP04] Martin Christopher and Helen Peck. Building the resilient supply chain. *The International Journal of Logistics Management*, 15(2):1–14, 2004.

[CP12] Felix T. S. Chan and Anuj Prakash. Inventory management in a lateral collaborative manufacturing supply chain: a simulation study. *International Journal of Production Research*, 50(16):4670–4685, 2012.

[CPJ99] Joseph P. Cannon and William D. Perreault Jr. Buyer–seller relationships in business markets. *Journal of Marketing Research*, 36(4):439–460, 1999.

[Cum04] Jonathon N. Cummings. Work groups, structural diversity, and knowledge sharing in a global organization. *Management Science*, 50(3):352–364, 2004.

[Dav93] Thomas H. Davenport. *Process innovation: reengineering work through information technology.* Harvard Business School Press, Brighton, Massachusetts, USA, 1993.

[Dru06] Peter F. Drucker. *Innovation and entrepreneurship.* HarperBusiness, New York, NY, USA, 2006.

[DS14] Paul Drews and Ingrid Schirmer. From enterprise architecture to business ecosystem architecture: Stages and challenges for extending architectures beyond organizational boundaries. In *Proceedings of the 18th International Enterprise Distributed Object Computing Conference Workshops and Demonstrations (EDOCW)*, pages 13–22, Ulm, Germany, 2014. IEEE.

[DS19] Bruna Diirr and Gleison Santos. A systematic literature mapping on interorganizational information systems. In *Proceedings of the 25th Americas Conference on Information Systems (AMCIS)*, Cancun, Mexico, 2019. AIS.

[EA16] G. Easton and B. Axelsson. *Non-economic exchange in industrial networks.* Routledge, Abingdon, Oxfordshire, England, UK, 2016.

[EE96] Lisa M. Ellram and Owen R. V. Edis. A case study of successful partnering implementation. *International Journal of Purchasing and Materials Management*, 32(3):20–28, 1996.

[EGH+15] Sergio España, Jānis Grabis, Martin Henkel, Hasan Koç, Kurt Sandkuhl, Janis Stirna, and Jelena Zdravkovic. Strategies for capability modelling: analysis based on initial experiences. In *Proceedings of the 27th International Conference on Advanced Information Systems Engineering (CAiSE)*, pages 40–52, Stockholm, Sweden, 2015. Springer.

[EGS16] Kathleen M. Eisenhardt, Melissa E. Graebner, and Scott Sonenshein. Grand challenges and inductive methods: Rigor without rigor mortis. *Academy of management journal*, 59(4):1113–1123, 2016.

[Ell00] Alexander E. Ellinger. Improving marketing/logistics cross-functional collaboration in the supply chain. *Industrial Marketing Management*, 29(1):85–96, 2000.

[ESSD08] Steve Easterbrook, Janice Singer, Margaret-Anne Storey, and Daniela Damian. Selecting empirical methods for software engineering research. In *Guide to Advanced Empirical Software Engineering*, pages 285–311. Springer London, London, England, UK, 2008.

[FMSN11] Andreas Freitag, Florian Matthes, Christopher Schulz, and Aneta Nowobilska. A method for business capability dependency analysis. In *International Conference on IT-enabled Innovation in Enterprise (ICITIE2011)*, Sofia, Bulgaria, 2011.

[Fre14] Andreas Freitag. *Applying business capabilities in a corporate buyer M&A process*. Springer Gabler Wiesbaden, Wiesbaden, Germany, 2014.

[Ger16] John Gerring. *Case study research: Principles and practices*. Cambridge University Press, Cambridge, England, UK, 2016.

[GFGK15] Johanna Gast, Matthias Filser, Katherine Gundolf, and Sascha Kraus. Coopetition research: towards a better understanding of past trends and future directions. *International Journal of Entrepreneurship and Small Business*, 24(4):492–521, 2015.

[GFM03] Susan L. Golicic, James H. Foggin, and John T. Mentzer. Relationship magnitude and its role in interorganizational relationship structure. *Journal of Business Logistics*, 24(1):57–75, 2003.

[GHH03] Lars-Erik Gadde, Lars Huemer, and Håkan Håkansson. Strategizing in industrial networks. *Industrial Marketing Management*, 32(5):357–364, 2003.

[GLGS21] Hong Guo, Jingyue Li, Shang Gao, and Darja Smite. Agile enterprise architecture by leveraging use cases. In *Proceedings of the 16th International Conference on Evaluation of Novel Approaches to Software Engineering (ENASE)*. SciTePress, 2021.

[Gra96] Robert M. Grant. Prospering in dynamically-competitive environments: Organizational capability as knowledge integration. *Organization science*, 7(4):375–387, 1996.

[Gro18a] The Open Group. *TOGAF Series Guide: Business Capabilities*. The Open Group, Reading, England, UK, 2018.

[Gro18b] The Open Group. The togaf standard, version 9.2. Online document, 2018. `https://pubs.opengroup.org/architecture/togaf92-doc/arch/`, Accessed: December 30, 2022.

[GSG09] Amit Goel, Heinz Schmidt, and David Gilbert. Towards formalizing virtual enterprise architecture. In *Proceedings of the 13th International Enterprise Distributed Object Computing Workshop (EDOCW)*, pages 238–242, Auckland, New Zealand, 2009. IEEE.

[GVL04] Frank Goethals, Jacques Vandenbulcke, and Wilfried Lemahieu. Developing the extended enterprise with the fadee. In *Proceedings of the ACM symposium on Applied Computing*, pages 1372–1379, Nicosia, Cyprus, 2004. ACM.

[Hag04] Svenja Hagenhoff. Kooperationsformen: Grundtypen und spezielle ausprägungen. *Arbeitsbericht*, 4, 2004.

[Han16] Inge Hanschke. *Enterprise Architecture Management-einfach und effektiv: Ein praktischer Leitfaden für die Einführung von EAM*. Carl Hanser Verlag GmbH & Co. KG, Munich, Germany, 2016.

[Har98] Chris Hart. *Doing a literature review: releasing the social science research imagination*. Sage Publications Ltd, London, England, UK, 1998.

[HDHS05] Matthias Holweg, Stephen Disney, Jan Holmström, and Johanna Småros. Supply chain collaboration:: Making sense of the strategy continuum. *European Management Journal*, 23(2):170–181, 2005.

[Hei94] Jan B. Heide. Interorganizational governance in marketing channels. *Journal of Marketing*, 58(1):71–85, 1994.

[Hom06] Ulrich Homann. A business-oriented foundation for service orientation. *Microsoft Developer Network (MSDN)*, 2006.

[HPL03] Cynthia Hardy, Nelson Phillips, and Thomas B. Lawrence. Resources, knowledge and influence: The organizational effects of interorganizational collaboration. *Journal of Management Studies*, 40(2):321–347, 2003.

[HS06] Håkan Håkansson and Ivan Snehota. No business is an island: The network concept of business strategy. *Scandinavian journal of management*, 22:256–270, 2006.

[IEE00] *IEEE Recommended Practice for Architectural Description for Software-Intensive Systems (IEEE Std 1471-2000)*. IEEE, New York, NY, USA, 2000.

[JI94] Sirkka L Jarvenpaa and Blake Ives. The global network organization of the future: Information management opportunities and challenges. *Journal of management information systems*, 10(4):25–57, 1994.

[JOT07] Burke Johnson, Anthony Onwuegbuzie, and Lisa Turner. Toward a definition of mixed methods research. *Journal of Mixed Methods Research (JMMR)*, 1(2):112–133, 2007.

[JV88] H. Russell Johnston and Michael R. Vitale. Creating competitive advantage with interorganizational information systems. *MIS Quarterly*, 12(2):153–165, 1988.

[Kel09] Wolfgang Keller. Using capabilities in enterprise architecture management. *White Paper, Object Architects*, 2009.

[Kel17] Wolfgang Keller. *IT-Unternehmensarchitektur : Von der Geschäftsstrategie zur optimalen IT-Unterstützung*. dpunkt Verlag, Heidelberg, Germany, 2017.

[Kil11] Stephan Killich. Formen der unternehmenskooperation. In *Netzwerkmanagement*, pages 13–22. Springer, Berlin, Heidelberg, Germany, 2011.

[KLFK10] Christopher Klinkmüller, André Ludwig, Bogdan Franczyk, and Rolf Kluge. Visualising business capabilities in the context of business analysis. In *Proceedings of the 13th International Conference on Business Information Systems (BIS)*, pages 242–253, Berlin, Germany, 2010. Springer.

[Kot17] Svyatoslav Kotusev. Enterprise architecture: what did we study? *International Journal of Cooperative Information Systems*, 26(04):1730002, 2017.

[KPE+13] Jan Kietzmann, Kirk Plangger, Ben Eaton, Kerstin Heilgenberg, Leyland Pitt, and Pierre Berthon. Mobility at work: A typology of mobile communities of practice and contextual ambidexterity. *The Journal of Strategic Information Systems*, 22(4):282–297, 2013.

[KSS15] Svyatoslav Kotusev, Mohini Singh, and Ian Storey. Investigating the usage of enterprise architecture artifacts. In *Proceedings of the 23rd European Conference on Information Systems (ECIS)*, Muenster, Germany, 2015. AIS.

[L+13] Marc Lankhorst et al. *Enterprise architecture at work: Modelling, Communication and Analysis*, volume 352. Springer, 2013.

[LDL03] Ann Lindsay, Denise Downs, and Ken Lunn. Business processes—attempts to find a definition. *Information and Software Technology*, 45(15):1015–1019, 2003.

[LE06] Yair Levy and Timothy Ellis. A systems approach to conduct an effective literature review in support of information systems research. *Informing Science Journal (InformingSciJ)*, 9:181–212, 2006.

[LEG99] Douglas M. Lambert, Margaret A. Emmelhainz, and John T Gardner. Building successful logistics partnerships. *Journal of Business Logistics*, 20(1):165–182, 1999.

[Lev60] Theodore Levitt. Marketing myopia. *Harvard Business Review*, 38(4):24–47, 1960.

[Loc07] Edwin A. Locke. The case for inductive theory building. *Journal of management*, 33(6):867–890, 2007.

[LSHdM15] Johan Linaker, Sardar Muhammad Sulaman, Martin Höst, and Rafael Maiani de Mello. Guidelines for conducting surveys in software engineering. *Department of Computer Science, Lund University*, 2015.

[LZP+10] Qing Li, Jian Zhou, Qi-Rui Peng, Can-Qiang Li, Cheng Wang, Jing Wu, and Bei-En Shao. Business processes oriented heterogeneous systems integration platform for networked enterprises. *Computers in Industry*, 61(2):127–144, 2010.

[Mat11] Dirk Matthes. *Enterprise Architecture Frameworks Kompendium: Über 50 Rahmenwerke für das IT-Management*. Springer, Berlin, Heidelberg, Germany, 2011.

[MBLS08] Florian Matthes, Sabine Buckl, Jana Leitel, and Christian M. Schweda. *Enterprise Architecture Management Tool Survey 2008*. Technical University of Munich, Munich, Germany, 2008.

[MDK+01] John T. Mentzer, William DeWitt, James S. Keebler, Soonhong Min, Nancy W. Nix, Carlo D. Smith, and Zach G. Zacharia. Defining supply chain management. *Journal of Business logistics*, 22(2):1–25, 2001.

[MGS05] Arvind Malhotra, Sanjay Gosain, and Omar A. El Sawy. Absorptive capacity configurations in supply chains: Gearing for partner-enabled market knowledge creation. *MIS quarterly*, 29(1):145–187, 2005.

[MKO07] Michael H. Morris, Akin Kocak, and Alper Ozer. Coopetition as a small business strategy: Implications for performance. *Journal of small business strategy*, 18(1):35–56, 2007.

[MM00] Ronan McIvor and Marie McHugh. Partnership sourcing: an organization change management perspective. *Journal of Supply Chain Management*, 36(2):12–20, 2000.

[MMS06] John T. Mentzer, Matthew B. Myers, and Theodore P. Stank. *Handbook of global supply chain management*. Sage Publications, Thousand Oaks, CA, USA, 2006.

[Moo96] James F. Moore. *The death of competition: leadership and strategy in the age of business ecosystems*. HarperBusiness, New York, NY, USA, 1996.

[MP14] Marcel Morisse and Corvin Prigge. Business continuity in network organizations–a literature review. In *Proceedings of the 20th Americas Conference on Information Systems (AMCIS)*, Savannah, Georgia, USA, 2014. AIS.

[MR08] Maria Madlberger and Narcyz Roztocki. Cross-organizational and cross-border is/it collaboration: a literature review. In *Proceedings of the 14th Americas Conference on Information Systems (AMCIS)*, Toronto, Canada, 2008. AIS.

[MRD+05] Soonhong Min, Anthony S. Roath, Patricia J. Daugherty, Stefan E. Genchev, Haozhe Chen, Aaron D. Arndt, and R. Glenn Richey. Supply chain collaboration: what's happening? *The international Journal of Logistics Management*, 16(2):237–256, 2005.

[MSLH02] Jie Meng, Stanley Y. W. Su, Herman Lam, and Abdelsalam Helal. Achieving dynamic inter-organizational workflow management by integrating business processes, events and rules. In *Proceedings of the 35th Annual Hawaii International Conference on System Sciences (HICSS)*, Big Island, HI, USA, 2002. IEEE.

[MSS+13] Tobias Mueller, Denis Schuldt, Birgit Sewald, Marcel Morisse, and Jurate Petrikina. Towards inter-organizational enterprise architecture management - applicability of togaf 9.1 for network organizations. In *Proceedings of the 19th Americas Conference on Information Systems (AMCIS)*, Chicago, USA, 2013. AIS.

[Mye97] Michael Myers. Qualitative research in information systems. *MIS Quarterly (MISQ)*, 21(2):241–242, 06 1997.

[NB97] Barry J. Nalebuff and Adam M. Brandenburger. Co-opetition: Competitive and cooperative business strategies for the digital economy. *Strategy & leadership*, 25(6):28–33, 1997.

[oD10] U.S. Department of Defense. The dodaf architecture framework version 2.02. Online document, 2010. `https://dodcio.defense.gov/library/dod-architecture-framework/`, Accessed: December 30, 2022.

[OSP17] Tyron Offerman, Christoph Johann Stettina, and Aske Plaat. Business capabilities: A systematic literature review and a research agenda. In *Proceedings of the 23rd International Conference on Engineering, Technology and Innovation (ICE/ITMC)*, Madeira, Portugal, 2017. IEEE.

[PK93] Alain Pinsonneault and Kenneth Kraemer. Survey research methodology in management information systems: an assessment. *Journal of Management Information Systems*, 10(2):75–105, 1993.

[PK08] Keith G. Provan and Patrick Kenis. Modes of network governance: Structure, management, and effectiveness. *Journal of Public Administration Research and Theory*, 18(2):229–252, 2008.

[PWKOS05] Walter W. Powell, Douglas R. White, Kenneth W. Koput, and Jason Owen-Smith. Network dynamics and field evolution: The growth of interorganizational collaboration in the life sciences. *American Journal of Sociology*, 110(4):1132–1205, 2005.

[PY16] Vik Pant and Eric Yu. Coopetition with frenemies: Towards modeling of simultaneous cooperation and competition among enterprises. In *Proceedings of the IFIP Working Conference on The Practice of Enterprise Modeling (PoEM)*, pages 164–178. Springer, 2016.

[RBM04] Gautam Ray, Jay B. Barney, and Waleed A. Muhanna. Capabilities, business processes, and competitive advantage: choosing the dependent variable in empirical tests of the resource-based view. *Strategic management journal*, 25(1):23–37, 2004.

[RD94] Marita Rupprecht-Däullary. Die zwischenbetriebliche kooperation. In *Möglichkeiten und Grenzen durch neue Informations- und Kommunikationstechnologien*, pages 5–31. Deutscher Universitätsverlag, Wiesbaden, Germany, 1994.

[REH+04] Lloyd M. Rinehart, James A. Eckert, Robert B. Handfield, Thomas J. Page Jr., and Thomas Atkin. An assessment of supplier—customer relationships. *Journal of Business Logistics*, 25(1):25–62, 2004.

[RH09] Per Runeson and Martin Höst. Guidelines for conducting and reporting case study research in software engineering. *Empirical Software Engineering (EMSE)*, 14(2):131–164, 2009.

[Rob02] Colin Robson. *Real World Research: A Resource for Social Scientists and Practitioner-Researchers*. Wiley-Blackwell, Hoboken, NJ, USA, 2002.

[RWR06] Jeanne W. Ross, Peter Weill, and David Robertson. *Enterprise architecture as strategy: Creating a foundation for business execution.* Harvard business press, Boston, USA, 2006.

[SC90] Anselm Strauss and Juliet Corbin. *Basics of Qualitative Research.* SAGE, Thousand Oaks, CA, USA, 1990.

[Sch04a] Jaap Schekkerman. Extended enterprise architecture framework (e2af) essentials guide. *Institute for Enterprise Architecture Developments (IFEAD)*, 2004.

[Sch04b] Jaap Schekkerman. *How to survive in the jungle of enterprise architecture frameworks: Creating or choosing an enterprise architecture framework.* Trafford Publishing, Victoria, Canada, 2004.

[Sch08] Marten Schöenherr. Towards a common terminology in the discipline of enterprise architecture. In *Proceedings of the International Conference on Service-Oriented Computing Workshops (ICSOC)*, pages 400–413. Springer, 2008.

[SDA99] Theodore P. Stank, Patricia J. Daugherty, and Chad W. Autry. Collaborative planning: supporting automatic replenishment programs. *Supply Chain Management*, 4(2):75–85, 1999.

[SEK07] Hanifa Shah and Mohamed El Kourdi. Frameworks for enterprise architecture. *IT Professional*, 9(5):36–41, 2007.

[SFN01] Ken G. Smith, Walter J. Ferrier, and Hermann Ndofor. Competitive dynamics research: Critique and future directions. *Handbook of Strategic Management*, pages 315–361, 2001.

[SGHZ12] Janis Stirna, Jānis Grabis, Martin Henkel, and Jelena Zdravkovic. Capability driven development–an approach to support evolving organizations. In *Proceedings of the IFIP Working Conference on The Practice of Enterprise Modeling (PoEM)*, pages 117–131. Springer, 2012.

[SH00] Alissa J. Stern and Tim Hicks. *The process of business/environmental collaborations: Partnering for sustainability.* Greenwood Publishing Group, Westport, CT, USA, 2000.

[SH15] Claudine Antoinette Soosay and Paul Hyland. A decade of supply chain collaboration and directions for future research. *Supply Chain Management*, 20(6):613–630, 2015.

[SS02] Togar M. Simatupang and Ramaswami Sridharan. The collaborative supply chain. *The International Journal of Logistics Management*, 13(1):15–30, 2002.

[Sta95] Robert Stake. *The Art of Case Study Research.* SAGE, Thousand Oaks, CA, USA, 1995.

[Tam17] Torben Tambo. Enterprise architecture beyond the enterprise: Extended enterprise architecture revisited. In *Proceedings of the 19th International Conference on Enterprise Information Systems (ICEIS)*, pages 381–390. SCITEPRESS Digital Library, 2017.

[Tan81] Judith M. Tanur. Advances in methods for large-scale surveys and experiments. *The 5-year Outlook on Science and Technology*, 2:589–619, 1981.

[TFC96] Peter Turnbull, David Ford, and Malcolm Cunningham. Interaction, relationships and networks in business markets: an evolving perspective. *Journal of Business & Industrial Marketing*, 11(3/4):44–62, 1996.

[TK05] Emanuela Todeva and David Knoke. Strategic alliances and models of collaboration. *Management Decision*, 43(1):123–148, 2005.

[Tor05] Richard Torraco. Writing integrative literature reviews: Guidelines and examples. *Human Resource Development Review*, 4(3):356–367, 2005.

[Trk10] Peter Trkman. The critical success factors of business process management. *International journal of information management*, 30(2):125–134, 2010.

[TSSR11] Toomas Tamm, Peter B. Seddon, Graeme Shanks, and Peter Reynolds. How does enterprise architecture add value to organisations? *Communications of the Association for Information Systems*, 28(10):141–168, 2011.

[TW89] Peter W Turnbull and David T Wilson. Developing and protecting profitable customer relationships. *Industrial Marketing Management*, 18(3):233–238, 1989.

[UR11] William Ulrich and Michael Rosen. The business capability map: the" rosetta stone" of business/IT alignment. *Cutter Consortium: Enterprise Architecture*, 14(2), 2011.

[US04] Dave Ulrich and Norm Smallwood. Capitalizing on capabilities. *Harvard Business Review*, 82(6):119–27, 2004.

[VBB13] Viswanath Venkatesh, Susan Brown, and Hillol Bala. Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems. *MIS Quarterly (MISQ)*, 37(1):21–54, 2013.

[VBCO13] Alix Vargas, Andrés Boza, Llanos Cuenca, and Angel Ortiz. Towards a framework for inter-enterprise architecture to boost collaborative networks. In *OTM Confederated International Conferences" On the Move to Meaningful Internet Systems"*, pages 179–188. Springer, 2013.

[VBSN+09] Jan Vom Brocke, Alexander Simons, Bjoern Niehaves, Kai Riemer, Ralf Plattfaut, and Anne Cleven. Reconstructing the giant: On the importance of rigour in documenting the literature search process. In *Proceedings of the 17th European Conference on Information Systems (ECIS)*, pages 2206–2217, Atlanta, GA, USA, 2009. AIS.

[Wen99] Etienne Wenger. *Communities of practice: Learning, meaning, and identity.* Cambridge University Press, Cambridge, England, UK, 1999.

[Wes19] Mathias Weske. *Business Process Management Architectures: Concepts, Languages, Architectures.* Springer, Berlin, Heidelberg, Germany, 2019.

[WF00] M. McLure Wasko and Samer Faraj. "it is what one does": why people participate and help others in electronic communities of practice. *The Journal of Strategic Information Systems*, 9(2-3):155–173, 2000.

[WF06] Robert Winter and Ronny Fischer. Essential layers, artifacts, and dependencies of enterprise architecture. In *Proceedings of the 10th International Enterprise Distributed Object Computing Conference Workshops (EDOCW)*, Hong Kong, 2006. IEEE.

[Wiß15] Matthias Wißotzki. An exploration of capability research. In *Proceedings of the 19th International Enterprise Distributed Object Computing Conference (EDOC)*, Adelaide, Australia, 2015. IEEE.

[WJ92] Frederick E. Webster Jr. The changing role of marketing in the corporation. *Journal of Marketing*, 56(4):1–17, 1992.

[WMS02] Etienne Wenger, Richard Arnold McDermott, and William Snyder. *Cultivating communities of practice: A guide to managing knowledge.* Harvard Business Press, Boston, USA, 2002.

[WRH+12] Claes Wohlin, Per Runeson, Martin Höst, Magnus Ohlsson, Björn Regnell, and Anders Wesslén. *Experimentation in Software Engineering.* Springer, Berlin, Heidelberg, Germany, 2012.

[WS08] Robert Winter and Joachim Schelp. Enterprise architecture governance: The need for a business-to-it approach. In *Proceedings of the ACM symposium on Applied computing*, pages 548–552. ACM, 2008.

[WS15] Matthias Wißotzki and Kurt Sandkuhl. Elements and characteristics of enterprise architecture capabilities. In *Proceedings of the International Conference on Business Informatics Research (BIR)*, pages 82–96. Springer, 2015.

[WT99] Sander Wennekers and Roy Thurik. Linking entrepreneurship and economic growth. *Small business economics*, 13(1):27–56, 1999.

[WTS07] Ingo Westphal, Klaus-Dieter Thoben, and Marcus Seifert. Measuring collaboration performance in virtual organizations. In *Working Conference on Virtual Enterprises*, pages 33–42. Springer, 2007.

[WW02] Jane Webster and Richard Watson. Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly (MISQ)*, 26(2):13–23, 2002.

[Yin15] Robert Yin. *Case Study Research: Design and Methods.* SAGE, Thousand Oaks, CA, USA, 2015.

[Zac87] John A. Zachman. A framework for information systems architecture. *IBM Systems Journal*, 26(3):276–292, 1987.

[ZFT11] Novica Zarvic, Michael Fellmann, and Oliver Thomas. Managing changes in collaborative networks: A conceptual approach. In *Proceedings of the 32nd International Conference on Information Systems (ICIS)*, Shanghai, China, 2011. AIS.

[ZP97] Walter Zinn and Arun Parasuraman. Scope and intensity of logistics-based strategic alliances: a conceptual classification and managerial implications. *Industrial Marketing Management*, 26(2):137–147, 1997.

[ZSG18] Jelena Zdravkovic, Janis Stirna, and Janis Grabis. Capability consideration in business and enterprise architecture frameworks. In *Capability Management in Digital Enterprises*, pages 41–56. Springer International, Cham, Switzerland, 2018.

[ZSHG13] Jelena Zdravkovic, Janis Stirna, Martin Henkel, and Jānis Grabis. Modeling business capabilities and context dependent delivery by cloud services. In *Proceedings of the 25th International Conference on Advanced Information Systems Engineering (CAiSE)*, pages 369–383, Valencia, Spain, 2013. Springer.

Publications

[YAM20] Fatih Yılmaz, Duygu Akdemir, and Florian Matthes. Why would enterprise architects work together? - a multiple case study. In *Proceedings of the 26th Americas Conference on Information Systems (AMCIS)*. Association for Information Systems, 2020.

[YFM21] Fatih Yılmaz, Julian Feldmeier, and Florian Matthes. Deriving a process for interorganizational business capability modeling through case study analysis. In *Proceedings of the 23rd International Conference on Enterprise Information Systems (ICEIS)*. SCITEPRESS – Science and Technology Publications, Lda, 2021.

[YM19] Fatih Yılmaz and Florian Matthes. Investigating the challenges of european public service media companies from an enterprise architecture point of view. In *Proceedings of the 23rd IEEE International Enterprise Distributed Object Computing Workshop (EDOCW)*. Institute of Electrical and Electronics Engineers, 2019.

[YM21] Fatih Yılmaz and Florian Matthes. Application of interorganizational business capability maps in different forms of horizontal enterprise architecture collaboration. In *Proceedings of the 23rd IEEE Conference on Business Informatics (CBI)*. Institute of Electrical and Electronics Engineers, 2021.

[YSM21] Fatih Yılmaz, Oliver Schmidt, and Florian Matthes. Interorganizational business capability maps: Use cases for horizontal collaboration. In *Proceedings of the 27th Americas Conference on Information Systems (AMCIS)*. Association for Information Systems, 2021.

Abbreviations

AMCIS Americas Conference on Information Systems

BCM Business Capability Map

BEA Business Ecosystem Architecture

CBI Conference on Business Informatics

EAM Enterprise Architecture Management

EA Enterprise Architecture

EEA Extended Enterprise Architecture

FA/CNA Federated or Collaborative Network Architecture

FBEA Focused Business Ecosystem Architecture

ICEIS International Conference on Enterprise Information Systems

IEEE Institute of Electrical and Electronics Engineers

IS Information System

IT Information Technology

P Publication

sebis Chair for Software Engineering for Business Information System

TUM Technical University of Munich

APPENDIX A

Embedded Publications in Original Format

Aug 10th, 12:00 AM

Why would Enterprise Architects work together? - A Multiple Case Study

Fatih Yilmaz
Technical University of Munich, fatih.yilmaz@tum.de

Duygu Akdemir
Technical University of Munich, duygu.akdemir@tum.de

Florian Matthes
Technical University of Munich, matthes@tum.de

Why would Enterprise Architects work together? – A Multiple Case Study

Completed Research

Fatih Yılmaz
Technische Universität München
fatih.yilmaz@tum.de
Institut für Rundfunktechnik GmbH
fatih.yilmaz@irt.de

Duygu Akdemir
Technische Universität München
duygu.akdemir@tum.de

Florian Matthes
Technische Universität München
matthes@tum.de

Abstract

In recent years, organizations are continuously confronted with the loss of market shares by competitors introducing new technologies and innovative business models. Instead of competing with these companies, organizations increasingly cooperate with competitors from the same industry. They are shifting from competition to cooperation to gain benefits by exchanging knowledge and identifying synergy potential. As cooperating organizations are usually connected regarding their processes and IT, the significance of inter-organizational enterprise architecture (EA) is increasing. However, often companies are not willing to share their internal EA knowledge and resources with others. This research is motivated by the lack of empirical studies on the collaboration between enterprise architects. Based on the result of 13 semi-structured interviews in two case studies, we present the motivation, aims, and benefits of enterprise architects in inter-organizational collaborations with others.

Keywords

Enterprise architecture, inter-organizational, collaboration, cooperation

Introduction

Nowadays, new competitors with disrupting technologies are forcing organizations to adapt their existing business models and technologies to remain competitive (Weill and Woerner 2015). Especially for historically grown large enterprises, this can be a challenging endeavor. James F. Moore (1996) explains this with the increasing number of similar business models and the internet allowing down-driven prices. He infers that organizations need to abandon the traditional thinking of competition which implies the existence of markets and the law of supply and demand. Companies must adapt themselves to the environment in which they operate as a whole ecosystem. This includes the shift from competition to coevolution with customers, suppliers, investors, and competitors (Moore 1996). Consequently, "cooperation has become more important than the competitive strategy" (Ganguli 2007). The cooperation strategy, however, is based on the company's motivation to cooperate and aim. As a result, they follow a specific collaboration form which is distinguished by its dimension and direction (Jagdev and Thoben 2001; Simatupang and Sridharan 2002).

Companies have to bear in mind that neither their business processes nor their IT are isolated from their business partners. In fact, companies are increasingly intertwined and interconnected with cooperating organizations (Drews and Schirmer 2014). Therefore, with the increasing number of cooperation partners and involved stakeholders, the company's IT complexity may arise. In this context, the concept of inter-organizational enterprise architecture management (EAM) is becoming an important part of cooperating companies. EAM in its intrinsic form is created for a single organization with the aim to improve its

business-IT alignment by proving a holistic view of the company's business, applications, information, and infrastructure (Weill and Ross 2009).

The literature reveals profound research addressing the field of inter-organizational business process management (Breu et al. 2013; Meng et al. 2002). Further, knowledge has been generated regarding the interoperability of IT systems (Bondel et al. 2019; Diirr and Santos 2019). As compared to, little research is conducted regarding the collaboration across individual organizations in the field of enterprise architecture. Nevertheless, attempts have been made to establish EAM frameworks or extend existing ones to support inter-organizational cooperation (Schekkerman 2004; Goethals et al. 2006; Mueller et al. 2013). Challenges with focus on extending internal enterprise architecture have been identified (Mueller et al. 2013; Drews and Schirmer 2014).

Although the number of collaborating organizations is increasing, there is a lack of academic research on the motivation for enterprise architects to interact with other enterprise architects and share their knowledge. Against this backdrop, we aim to fill this gap by defining the following research questions (RQ):

RQ1: What are the driving forces for enterprise architects of horizontally cooperating companies to work together?

RQ2: Which aims and objectives do enterprise architects pursue while collaborating with others?

RQ3: What are the resulting benefits from the cooperation with other enterprise architects?

Related Work

Based on the defined research questions, our literature review focuses on research on inter-organizational enterprise architecture models. We could find several papers addressing the topic of inter-organizational enterprise architecture, which shows the interest of current research in this area. However, we noticed that researchers use different terms like extended or inter-organizational enterprise architecture to discuss architectural activities between multiple enterprises.

Tambo (2017) addresses the concept of extended enterprise architecture by discussing the theories of business interaction of supply chain management, business relationship management, and inter-organizational information systems. His literature review on extended enterprise architecture reveals that the term is comprehensive without a precise definition and that the underlying complexities of the term have not been adequately covered in the literature. Based on the literature, Tambo (2017) proposes six notions for addressing inter-organizational challenges regarding the architecture, which are precision, imbalance, heterogeneity, transformation, temporality, and maturity.

Schekkerman (2004) proposes the Extended Enterprise Architecture Framework (E2AF) as a communication framework. This framework aims to enable and support the communication between the participated stakeholders of an architecture program. He defines different viewpoints such as privacy, governance, and security. One aspect describes the extended enterprise perspective concerning value net relations, information exchange, interoperability, and inter-connection. However, Schekkerman (2004) does not provide a sufficient explanation of whether the model addresses external relationships (Tambo 2017).

Based on a multiple case study conducted in the sector of logistics, health care, retail, and education, Drews and Schirmer (2014) describe a five-stage development from enterprise architecture to an inter-organizational business ecosystem architecture. The first stage defines the enterprise architecture for a single company. The second stage is characterized by involving customers, partners, and suppliers. This stage constitutes the extent of enterprise architecture, which is organized from the viewpoint of a key player. The federated or collaborative network architecture represents the third stage. In this stage the participants starting to share information about their enterprise architecture. The next stage describes the phase in which a company analyzes the architecture of selected stakeholders. The last stage comprises the whole ecosystem and is referred to as the business ecosystem architecture. Further, Drews and Schirmer (2014) identify 16 challenges of inter-organizational relationships from a business ecosystem perspective. These challenges have been classified into four categories, namely modeling extended enterprise architecture and business ecosystem architecture, tools, management, and socio-technical. In addition,

they provide four existing solutions to manage the described challenges, which include common standards, ontology, framework, vocabulary, and practices for data exchange.

Mueller et al. (2013) focus on the support of inter-organizational relationships by using The Open Group Architecture Framework (TOGAF) 9.1. On the basis of a literature review, they identified six types of challenges of network organizations concerning their implementation and operation. These types are governance, infrastructure and application integration, process and data integration, organization of network organization, social issues, and strategy. By applying the TOGAF 9.1 in order to cope with these challenges, they analyzed whether the framework is appropriate for network organization. The results show that TOGAF 9.1 is suitable for the challenges regarding infrastructure and application integration, process and data integration, governance, and strategy, while it does not yet provide support for challenges concerning the organization of network organization. In addition, TOGAF only addresses challenges of social issues on a meta-level. Based on these results, Mueller et al. (2013) take the view that the existing TOGAF 9.1 is not an appropriate framework for network organization and needs to be extended.

Diirr and Cappelli (2018) focus on collaboration across individual organizations and conduct a systematic literature review on cross-organizational relationship management. Based on the literature review, they propose nine major categories of cross-organizational relationships. These include motivation, definition, types of relationship, structure, lifecycle, analysis, benefits, challenges, and further research areas. According to the literature, they define cross-organizational collaboration as a process of exchanging knowledge and experience, sharing resources, and enhancing their possibility. In addition to the benefits of collaboration with organizations like producing new products and sharing risks, organizations also face challenges, which are classified into external challenges, internal challenges, and network-related challenges. However, Diir and Cappelli (2018) identify three open issues that require further investigation. These issues concern the creation including the choice of partner, the operation and evaluation including the provided infrastructure, and the dissolution of a collaboration.

Lachenmaier et al. (2018) propose recommendations to prepare the architecture of organizations for cooperation. These recommendations are retrieved from a project for the development of reference architectures for intelligent traffic services and related to different levels of an enterprise architecture. The vision and strategy level include the recommendation that the involved organizations have to define a clear goal and be aware of the risks associated with the cooperation. At the business level, it is proposed to offer service level agreements between the organizations in order to set up regulations concerning the collaboration. This can comprise the exchange of data and financial regulations. At this level, a common glossary, definition of important terms to support the communication between the organizations, and modeling the core process to have a clear view of the roles and their activities, is also recommended. The information level deals with the provision of interfaces for the systems in order to enable data exchange. In particular, the specification of data objects and the correct delivery of data takes an important function here. At the next level, namely the IT infrastructure, they advise the sharing of architectural principles. According to Lachenmaier et al. (2018), an architecture governance board and decision-making body should be established at the governance level.

Case Study Design

Yin (2017) explains a case study as an inquiry that investigates a contemporary phenomenon within its real-life context. Since we are interested in the motivation, aims, and benefits of enterprise architects regarding inter-organizational collaboration in the field of EAM, a case study is a suitable research methodology. In our research, we follow the guidelines for conducting and reporting case study research in software engineering by Runeson and Höst (2009). Further, since we focused on "in-depth accounts of experienced and perceptions with individuals", we conducted semi-structured interviews to gather insight (Cousin 2009).

Design and Plan: The main objective of this case study is the identification of the motivation for enterprise architects to collaborate with architects from other organizations within the same industry. We further identify the aims and experienced benefits resulting from such collaborations. Derived from this, we defined three research questions as mentioned in the introduction section. To increase the reliability of

results, we conducted a multiple case study with two national and international inter-organizational EAM initiatives.

Prepare and Collect: In total, we interviewed 13 enterprise architects in two inter-organizational projects. Due to geographical distance, the interviews were conducted via phone or video call. Originating from the field of supply chain management, the collaboration direction defines the relationship between the involved companies in the collaboration. In both case studies, the companies collaborate horizontally. This means, they are "unrelated or competing organizations cooperate to share their private information or resources" (Simatupang and Sridharan 2002). However, the case study partners pursue different objectives by the collaboration. The first project consists of eleven companies structured as a working group following the task of a consortium of top IT managers to reveal consolidation opportunities in the IT landscape. According to the definition of Wenger et al. (2002), the second case study is a community of practice between four companies interested in the knowledge exchange and development of an industry-specific reference model of a business capability map. None of the projects follow a given hierarchical order. However, the first project includes associated members, without a vote. In both case studies, the participants meet regularly in a physical or virtual way. Further information on interviewed companies is summarized in Table 1.

Analyze and Conclude: The interviews were recorded, transcribed and coded by using the qualitative data analysis tool MAXQDA. The consolidated phrases were clustered into statements, which address the previously defined research questions. By clustering the data from the interviews, we could consolidate to ten driving forces for collaboration and eight corresponding objectives. However, some interviewees did not see the difference between these two cluster. In these cases, we had to intervene and clarify. Further, eight benefits were identified. Only items mentioned by at least 10% of the participants were considered in the results.

	Case study 1	**Case study 2**
Number of interviewees	11	2
Collaboration direction	Horizontal collaboration	Horizontal collaboration
Collaboration type	Working group	Community of practice
Inter-/nationality	National	International
Number of involved companies	11	4
Structure of the meetings	• One coordinator • No hierarchy • Includes associated members	• One coordinator • No hierarchy
Meeting frequency & duration	Physically meetings: once per quarter over 1-2 days Virtually meetings: frequently in sub-groups, occasionally in working group	Physically meetings: once per quarter over 1 day Virtually meetings: every second week over 2-3 hours

Table 1. Overview and Specifics of Case Groups

Results

In the following subsections, we will present the results of the conducted interviews. Based on the number of interviewees mentioned each item, we defined its relevance.

Reason for Collaboration

In total, we could identify 10 triggers and driving forces for inter-organizational collaboration in the field of EAM. Each reason is listed in Table 2 and is sorted by descending relevance. The relevance is defined by the percentage share of the interviewees who mentioned the reason.

(1) Reveal IT cost-saving opportunities: Almost every interviewee in the first case study mentioned cost-saving as the main trigger for the collaboration. The top IT management of each company recognized the need for saving costs (Interviewee (I) 1, Case Study (CS) 1; I 3, CS 1). Thus, they decided to start a common EAM initiative in form of a cross-border working group to identify opportunities for reducing costs in their own organizations (I 2, CS 1; I 4, CS 1).

(2) Knowledge and experience sharing: One major reason to collaborate with other enterprise architects in both cases was the desire to exchange knowledge and experience. However, this trigger was more dominant in the second case study. In this project, we can observe voluntarily participation. Each member is part of a community of practice, which works on an industry-specific reference model. After its completion, it will be distributed in the community to increase the common understanding of the industry-specific business and language (I 9, CS 2).

(3) Tradition of cooperation across the companies: The interviewees of case study 1 told us, that this is not the first collaboration between these companies. These companies have a tradition to collaborate with other organizations from the same industry. Therefore, the organizations have already worked together in different areas (I 6, CS 1).

(4) Identify and support potential cooperation projects: More than one third of the interviewees told us, they would collaborate with the others to identify and support further potential cooperation projects (e.g. in the procurement of working materials) (I 1, CS 1).

(5) Increase efficiency among each company: The interviewees are participating in the collaborative EAM initiatives to gain insights into other companies from the same industry and identify benefits for their own company. Nevertheless, they are still willing to share their knowledge but also hope to increase the efficiency of their own company (I 7, CS 1).

(6) Driven by research institution: In both cases, the idea of collaborating in the field of EAM was mainly driven by research institutions. It was presented as a promising approach to increase the communication between companies from the same industry (I 2, CS 1; I 4, CS 1).

(7) Increase communication: A small number of participants followed the same intention as the research institutions and mentioned the desire to increase communication among the companies and their employees. They want to achieve direct communication with other enterprise architects in other companies (I 5, CS 1).

(8) Increase the cooperation between the companies: Corresponding to the reason (4) some participants are interested in increasing the overall cooperation between the involved companies. In contrast to the previously mentioned trigger (7), this reason refers to strategic cooperation between companies and not individuals (I 6, CS 1).

(9) Increase transparency and reduce silos: For 18% of the interviewees, the reason for attending the cooperation initiatives had a strategic character. By integrating other enterprise architects and involving them in discussions they intended higher transparency among the companies (I 10, CS 1; I 11, CS 1). But on the other hand, we could observe a conflict between individual and common interests of the community (I 1, CS 1; I 2, CS 1).

(10) Identify standardization opportunities and establish a reference architecture: A small group of participants named a very concrete reason to collaborate with other enterprise architects. They are part of the community to establish a reference architecture and identify standardization opportunities (I 10, CS 1; I 11, CS 1). This is not further surprising since standardization by the use of reference architectures describe a very essential aspect of EAM.

In the end, the importance of collaboration was vividly described by one interviewee:

"Two heads are better than one. Two think more than one. Four ears hear more than two." – I 10, CS 1

Triggers and driving forces for collaboration	**Mentioned by interviewees**	
	Case study 1	**Case study 2**
Reveal IT cost-saving opportunities	82%	-
Knowledge and experience sharing	36%	100%
Tradition of cooperation across the companies	36%	-
Identify and support potential cooperation projects	36%	-
Increase efficiency among each company	27%	50%
Driven by research institution	27%	100%
Increase communication	18%	-
Increase the cooperation between the companies	18%	-
Increase transparency and reduce silos	18%	-
Identify standardization opportunities and establish a reference architecture	18%	-

Table 2. Triggers and Driving Forces for inter-organizational EAM

Besides the triggers and driving forces for collaboration with other enterprise architects, we also asked for the aim and objectives of this cooperation. As might be expected, in some cases the aims are corresponding to the previously described triggers. We summarized the outcome of the interviews and their relevance in Table 3.

(1) Identification of cost-saving opportunities: Corresponding to the first identified trigger, the majority of the participants want to identify concrete cost-saving opportunities. This can be realized by (4) identifying cooperation projects, such as a joint purchase of specific products or systems by one organization to enable cost-benefits (I 1, CS 1).

(2) Ensure comparability and adaptability: Although located in the same industry, companies do not have to have the same business processes and even less likely they use the same IT systems. Therefore, it can be challenging to ensure comparability and adaptability among these organizations. The participants of the working group are aiming to solve this issue by developing of a common reference architecture. After all, the involved organizations are in the same industry and should, therefore, perform similar tasks with similar IT systems (I 4, CS 1).

(3) Improvement of own developed concepts: When establishing a common model and concept, the community often starts with existing ones provided by one or more participants. These concepts are often internally developed and used by a single organization and are iteratively refined by the community. However, this is also a possibility for the organization, which developed the concept to get feedback and enhance their own model (I 12, CS 2).

(4) Identification and support of cooperation projects: Closely related to the fourth mentioned trigger, some enterprise architects are seeking further cooperation projects resulting from the current one. By identifying fields of action (e.g. consolidation potential in the application landscape) they want to point to new cooperation opportunities (I 7, CS 1).

(5) Establishment of an industry-wide reference model: Participants in both case studies are working on a common reference architecture model. However, this aim was especially mentioned by interviewees from the second case study. Currently, this international community is working on an industry-specific business capability map as a tool for common language (I 13, CS 2).

(6) Establishment of a common EAM methodology: The participants within the working group (case study 1) collaborate very closely to identify standardization opportunities, e.g. in their IT landscape. For that reason, they decided to establish an inter-organizational EAM methodology which includes a

common EAM tool, same configurations in the repositories and common understanding of terminologies (I 1, CS 1; I 3, CS 1).

(7) Development of a common application landscape: Following the previously mentioned aim (6), the working group also intends to create a common landscape including the applications of each organization. This can further be used to (1) identify cost-saving opportunities by comparing or even consolidating applications performing the same task (I 3, CS 1).

(8) Encourage exchange and communication between organizations: Only two interviewees outline goals related to the exchange of data (I 2, CS 1).

Aim of the collaboration	**Mentioned by interviewees**	
	Case study 1	**Case study 2**
Identification of cost-saving opportunities	64%	-
Ensure comparability and adaptability	45%	-
Improvement of own developed concepts	27%	50%
Identification and support of cooperation projects	27%	-
Establishment of an industry-wide reference model	18%	50%
Establishment of a common EAM methodology	18%	-
Development of a common application landscape	18%	-
Encourage exchange and communication between organizations	18%	-

Table 3. Aims and Objectives of inter-organizational EAM

Benefits of Collaboration

Besides the motivation and aim of the collaboration, the interviewees were asked about the benefits of cooperation with other companies. Overall, we could identify eight benefits from the interviews. They are listed in descending order of relevance (see Table 4) and will be described in the following:

(1) Exchange of personal and professional experiences: The members share their experiences by discussing and reporting the advantages and disadvantages of certain methods and what the requirements of EAM in each organization are (I 1, CS 1; I 2, CS 1; I 7, CS 1). Due to the exchange, they will be encouraged to gain a broader point of view on EAM and think outside the box (I 7, CS 1). These discussions are not only related to enterprise architecture but can also refer to plans and projects that are started in the individual companies (I 7, CS 1). Further, the participants are also talking about personal experiences they gained during for instance conferences.

(2) Learn from others: This benefit implies learning from other community members like gaining different approaches for certain problems (I1, O1). Additionally, this leads to self-reflection and self-improvement (I3, O3). Especially, the associated members, benefit from learning from the working group. They observe and contribute ideas for new concepts that can then be tested in practice by the working group without binding impacts on their organization (I2, O2).

(3) Benefit from other works: Besides the working group, many participants also work on EAM tasks within their organizations. Thus, certain works are pushed forward and made available for the rest of the community. In this way, the members who are short on EAM knowledge can benefit from the work of experienced members. They can, for instance, provide the internal architectural principles of the organization (I 1, CS 1; I 8, CS 1). This is also a chance for associated members to adopt the presented ideas in their own company (I 2, CS 2).

(4) Save time: As mentioned before, team members benefit from reusing the work results or at least parts of it provided by other team members. Participants do not need to reinvent concepts that are already used in other organizations. This leads to a more efficient way of working (I 1, CS 1; I 6, CS 1; I 1, CS 1).

(5) Get support with specific questions and problems: Within the collaboration, the members support each other and act as a contact person for specific problems. They can directly contact each other asking for advice or consultation. Even though, the contact person is not able to solve the problem he could internally forward the request of the community member (I 6, CS 1).

(6) Maintain accepted standards and models: Some interviewees mentioned that frameworks and standards gain more acceptance within their organization if they are already applied within several organizations. Further, the reputation of a collaboratively developed model is perceived to be higher. This can otherwise only be achieved by obtaining external consulting services, which are usually assigned higher credibility than the company's own developments. In particular, at a lower maturity level of EAM this can be beneficial (I 3, CS 1; I 9, CS 1).

(7) Increase development of EAM: The development and improvement of EAM is accelerated by the cooperation and contribution of all participating organizations (I 5, CS 1; I 6, CS 1). Without the input of others, some activities, like the creation of a shared application landscape or business capability map, would not be possible. The collaboration provides a benefit for the members in so far as it is not possible to work on these topics in such a high detail in their own companies as it is given in the working group (I 10, CS 1). One reason for that is the lack of resources in each organization (I 6, CS 1).

(8) Gain higher quality of work: The benefit which the participants of the community of practice perceive is a higher quality of already existing models. By providing a more sharp and complete version they can continuously improve their work (I 12, CS 2; I 13, CS 2).

While the organizations in the working group mentioned seven of the nine benefits, the international community of practice brings up two benefits of "maintaining accepted standards and models" and "gaining a higher quality" of already developed models. This can be explained by the fact that the first case study works together in multiple areas of EAM. The community, on the other hand, works on establishing a common business capability model, by merging and refining the models they already developed in their organizations.

Benefits of the collaboration	**Mentioned by interviewees**	
	Case study 1	**Case study 2**
Exchange of personal and professional experiences	81%	-
Learn from others	36%	-
Benefit from other works	36%	-
Save time	27%	-
Get support with specific questions and problems	18%	-
Maintain accepted standards and models	18%	50%
Increase development of EAM	18%	-
Gain higher quality of work	-	100%

Table 4. Benefits of inter-organizational EAM

Conclusion and Outlook

Motivated by the fact that changing business environments encourage organizations to cooperate with other companies, the relevance of inter-organizational enterprise architecture is becoming increasingly important. Based on that, we investigated the reason for collaboration between organizations in the field of EAM. Thus, we defined three research questions addressing the motivation, aims, and benefits for enterprise architects in such cooperation projects. In a multiple case study was conducted 13 interviewees from eleven organizations of two working groups. This work contributes to a deeper understanding of inter-organizational collaboration in the field of enterprise architecture by providing results in the previously mentioned three units of analysis.

The findings show that enterprise architects do not follow the same motivation for cooperation. This results from two different types of cooperation settings with various cooperation objectives. We identified that in a working group with closely related organizations, the top IT management can act as principal for e.g. identifying cost-saving opportunities. While the community of practice is created out of voluntary exchange of knowledge and experience of individuals with common interests. They mainly collaborate with enterprise architects to jointly develop an industry-wide reference model (e.g. business capability model). The working group is also working on a reference model, but in contrast to the community of practices, they use it as a tool to increase transparency and comparability between the organizations and identify potential cooperation projects. In both case studies the interviewees told us, they would benefit from the cooperation. But due to its non-binding nature, the implementation of the jointly developed methods and concepts in each organization remains optional and can only be decided by the organization's IT management. However, the realization of the solutions in individual companies encourages and facilitates better cooperation. For the working group, it was highly beneficial to exchange personal and professional experiences. The participants of the second case study perceive the overall higher quality of work as an advantage of the collaboration. All in all, these findings enable us to successfully answer the predefined research questions by revealing the driving forces, aims, and benefits of collaborative enterprise architecture.

Case studies can include limiting factors such as validity, generalizability, and reliability (Runeson and Höst 2009). Construct validity reflects the investigated operational measures related to the objective that the researcher intended to maintain with the study and the research questions. To ensure this, the following three countermeasures have been taken: (1) a second researcher reviewed the interview guideline to avoid misunderstanding of questions, (2) conduction of semi-structured interviews with employees from different organizations with the necessary background, and (3) the coding of the interviews was also reviewed by a second researcher. Internal validity can be ignored, due to the fact, that the paper does not include exploratory research or hypothesis testing. External validity describes to what extent the obtained results can be generalized and whether the results are of interest to people outside the case study. The case study followed the intention to create an analytical generalization. It focuses on providing a deeper understanding of collaboration in the field of EAM across organizations. The results can be used to gain an impression on the motivation for such a collaboration. The reliability aspect addresses the traceability of the analysis and results of the study. To fulfill this criterion, the interviews were following a previously defined guideline reviewed by a second researcher. Secondly, a case study database, including the recordings and transcripts, was developed as recommended by Yin (2017). However, the interviews were conducted and coded by a single researcher. Yet, as described, attempts have been made to avoid biased results.

Interviews tend to be subjective since they represent the personal opinion and experience of the interviewee. The result can be further improved by interviewing more companies and people. The case study could be extended to further industries with horizontal collaboration. However, at present time organizations seem to be rather reserved regarding cooperation in the field of EAM. As a result, new reasons, aims, and benefits can be identified and the existing ones confirmed.

REFERENCES

Bondel, G., Bui, D. H., Faber, A., Seidel, D., and Hauder, M. 2019. "Towards a Process and Tool Support for Collaborative Api Proposal Management," *Proceedings of the 25th Americas Conference on Information Systems*, Cancun.

Breu, R., Dustdar, S., Eder, J., Huemer, C., Kappel, G., Köpke, J., Langer, P., Mangler, J., Mendling, J., and Neumann, G. 2013. "Towards Living Inter-Organizational Processes," *2013 IEEE 15th Conference on Business Informatics*: IEEE, pp. 363-366.

Cousin, G. 2009. *Researching Learning in Higher Education: An Introduction to Contemporary Methods and Approaches*. Routledge.

Diirr, B., and Cappelli, C. 2018. "A Systematic Literature Review to Understand Cross-Organizational Relationship Management and Collaboration," *Proceedings of the 51st Hawaii International Conference on System Sciences*.

Diirr, B., and Santos, G. 2019. "A Systematic Literature Mapping on Interorganizational Information Systems," *Proceedings of the 25th Americas Conference on Information Systems*, Cancun.

Drews, P., and Schirmer, I. 2014. "From Enterprise Architecture to Business Ecosystem Architecture: Stages and Challenges for Extending Architectures Beyond Organizational Boundaries," *2014 IEEE 18th International Enterprise Distributed Object Computing Conference Workshops and Demonstrations*: IEEE, pp. 13-22.

Ganguli, S. 2007. "Coopetition Models in the Context of Modern Business," *The Icfai Journal of Marketing Management* (6:4), pp. 6-16.

Goethals, F. G., Snoeck, M., Lemahieu, W., and Vandenbulcke, J. 2006. "Management and Enterprise Architecture Click: The Fad (E) E Framework," *Information Systems Frontiers* (8:2), pp. 67-79.

Jagdev, H. S., and Thoben, K.-D. 2001. "Anatomy of Enterprise Collaborations," *Production planning & control* (12:5), pp. 437-451.

Lachenmaier, J. F., Pfähler, K., and Kemper, H.-G. 2018. "Enterprise Architecture Management in Dynamischen Wertschöpfungsnetzwerken–Empfehlungen Zur Interoperabilität," in: *Multikonferenz Wirtschaftsinformatik 2018*. Lüneburg, Germany.

Meng, J., Su, S. Y., Lam, H., and Helal, A. 2002. "Achieving Dynamic Inter-Organizational Workflow Management by Integrating Business Processes, Events and Rules," *Proceedings of the 35th annual Hawaii international conference on system sciences*: IEEE, p. 10 pp.

Moore, J. F. 1996. *The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems*. New York: HarperBusiness.

Mueller, T., Schuldt, D., Sewald, B., Morisse, M., and Petrikina, J. 2013. "Towards Inter-Organizational Enterprise Architecture Management - Applicability of Togaf 9.1 for Network Organizations," *Proceedings of the 19th Americas Conference on Information Systems*, Chicago: Association for Information Systems.

Runeson, P., and Höst, M. 2009. "Guidelines for Conducting and Reporting Case Study Research in Software Engineering," *Empirical software engineering* (14:2), p. 131.

Schekkerman, J. 2004. "Extended Enterprise Architecture Framework (E2af) Essentials Guide," in: *Institute for Enterprise Architecture Developments*.

Simatupang, T. M., and Sridharan, R. 2002. "The Collaborative Supply Chain," *The international journal of logistics management* (13:1), pp. 15-30.

Tambo, T. 2017. "Enterprise Architecture Beyond the Enterprise-Extended Enterprise Architecture Revisited," *Proceedings of the 19th International Conference on Enterprise Information Systems - Volume 1: ICEIS*, pp. 381-390.

Weill, P., and Ross, J. W. 2009. *It Savvy: What Top Executives Must Know to Go from Pain to Gain*. Harvard Business Press.

Weill, P., and Woerner, S. L. 2015. "Thriving in an Increasingly Digital Ecosystem," *MIT Sloan Management Review* (56:4), p. 27.

Wenger, E., McDermott, R. A., and Snyder, W. 2002. *Cultivating Communities of Practice: A Guide to Managing Knowledge*. Harvard Business Press.

Yin, R. K. 2017. *Case Study Research and Applications: Design and Methods*. Sage publications.

Aug 9th, 12:00 AM

Interorganizational Business Capability Maps: Use Cases for Horizontal Collaboration

Fatih Yilmaz
Technical University of Munich, fatih.yilmaz@tum.de

Oliver Schmidt
Technical University of Munich, oliver.schmidt@tum.de

Florian Matthes
Technical University of Munich, matthes@tum.de

Interorganizational Business Capability Maps: Use Cases for Horizontal Collaboration

Completed Research

Fatih Yılmaz
Technische Universität München
fatih.yilmaz@tum.de

Oliver Schmidt
Technische Universität München
oliver.schmidt@tum.de

Florian Matthes
Technische Universität München
matthes@tum.de

Abstract

Nowadays, organizations are under the pressure of changing business environments, including continuously changing customer needs and technological innovations. In order to remain competitive, they are increasingly engaging in collaborations with their customers, suppliers, and competitors. Enterprise architecture management (EAM) and business capabilities can help to monitor the complexity of such an endeavor by illustrating the alignment of business and IT beyond the company's boundaries. Our research is motivated by the lack of empirical studies on use cases of collaboratively developed business capabilities. By conducting a multiple case study, we present 19 use cases for interorganizational business capability maps (BCM) in horizontally collaborating organizations. Further, we map these to common challenges in interorganizational enterprise architecture (EA) collaborations, which we identified in the literature and evaluated in case studies.

Keywords

Business capability map, use cases, interorganizational, collaborative, multiple case study

Introduction

In the last decade, organizations increasingly face challenges due to unpredictable business environments with disruptive technologies, rapidly changing customer demands, and new regulations (Sherehiy et al. 2007). There is a growing shift towards interorganizational collaboration in order to cope with these challenges. Organizations move from competition to coevolution with their customers, suppliers, and competitors. They adapt themselves to the surroundings and start operating as an ecosystem (Moore 1996). By engaging in cooperation, organizations pursue diverse aims like knowledge exchange, cost reduction, and increased flexibility (Yilmaz et al. 2020). The collaboration strategy, however, is based on the organization's aims, structure, and motivation to collaborate. Therefore, each company follows an individual cooperation form which differs in its direction and dimension (Simatupang and Sridharan, 2002). For instance, horizontal collaboration with companies from the same industry or even competitors.

Providing a holistic view of the organization with its business and IT components, business capabilities can help to align these components and illustrate their complexity (Ulrich and Rosen 2011). Especially when companies follow the same value chain, as it is the case in horizontal cooperation, modeling and use of a common business capability map (BCM) seem to be natural. This potential was also recognized by researchers and practitioners (Yilmaz et al. 2021). Although the concept of business capabilities was initially designed for single organizations, there is an increasing interest in research on the application of the BCM in an interorganizational context (Bakhtiyari et al. 2015). However, extant literature does not provide an overview of the possible use cases of interorganizational BCM in horizontally cooperating companies. To fill this gap, we defined the following research questions (RQ):

RQ 1:What are possible use cases for the BCM in horizontal interorganizational collaboration?

RQ 2: What are recurring challenges in interorganizational enterprise architecture (EA) collaborations, and can the BCM address them?

Related Work and Background

We conducted a comprehensive literature review on current application scenarios of BCMs and challenges in interorganizational EA initiatives according to proven guidelines (Webster and Watson 2002). This review provides the baseline for our investigation and uncovers gaps.

The possible applications of BCMs range from application management to strategic decisions such as outsourcing (Aleatrati Khosroshahi et al. 2018; Bondel et al. 2018). The concept of interorganizational BCMs is a relatively recent development with limited research conducted. Bakhtiyari et al. (2015) present a capability-based approach for enterprise architecture to plan business networks. They introduce "novation requirements" to capture correspondences between organizations in a business network. These novation requirements act in the business network with the help of a global BCM as a connector between the business capabilities of individual organizations. Fleischer et al. (2007) use business capabilities to arrange and evaluate value-added networks. This enables the management of individual nodes within the network. The presented process allows the configuration of value-added networks. A BCM is created to compare the business capabilities of the individual nodes and map them to the nodes of the network. These papers present distinct usage scenarios for the BCM, but with different collaboration settings. In contrast, our research presents a holistic view of possible use cases of BCMs in horizontal interorganizational EA collaborations.

Given the complexity of business networks, it is important to know the main challenges that arise when engaging in interorganizational EA collaborations. We therefore conducted a literature review with the following search string: *("Ecosystem" OR "Inter-organizational" OR "Cross-organizational" OR "Virtual organization" OR "Network environment" OR "Business network") AND ("Enterprise Architecture") AND ("Challenge" OR "Risk" OR "Problem")*. Based on the previously defined research domain, we selected the electronic databases ScienceDirect, EBSCOhost, Scopus, Association for Computing Machinery (ACM), Electrical and Electronics Engineers (IEEE), and Web of Science. After conducting a forward and backward search we analyzed 124 papers in total. The review resulted in a comprehensive list of 32 challenges prioritized to 15 challenges according to the number of sources. These challenges served as a foundation for the evaluation by the case study experts at a later stage.

The most mentioned challenge in EA collaborations is the *lack of information and knowledge sharing*. It describes the problem of missing, insufficient, or ambiguous exchange of information and knowledge (Mueller et al. 2013; Malhotra et al. 2005). The challenge of *missing trust and commitment* describes the time-consuming process of establishing trust and commitment among involved organizations in a business network. This can hinder the sharing of information (Alawamleh and Popplewell 2010; Provan and Kenis 2008). *Heterogeneity and lack of standardization* is the third most frequently mentioned challenge and describes the heterogeneity at different levels between participants in a network (e.g., incompatible infrastructure and business processes) (Morisse and Prigge 2014). The *identification and management of risks* were described as a challenge in eight different articles and describe the lack of understanding risks that may occur and the actions to resolve them (Alawamleh and Popplewell 2010; Chopra and Sodhi 2004). *Failing communication and timely response* can make it difficult to collaborate with others. This challenge is concerned with effective and efficient interorganizational communication, which requires a common language to share information and knowledge (Morisse and Prigge 2014; Westphal et al. 2007). *Ontology difference* as a challenge refers to the absence of a formal, explicit specification of a shared conceptualization or schematics. Additionally, misaligned models and languages can result in impeded communication (Alawamleh and Popplewell 2010; Drews and Schirmer 2014). The *identification and selection of the right business partner* depend on the own and the partner's objectives, strategies, core competencies, and capabilities. This can complicate the selection of partners (Alawamleh and Popplewell 2010; Goel et al. 2009). Finding the right *balance of benefits and costs* is a ubiquitous challenge that can be found at different organizational levels, such as cost-intensive interconnections between IT systems or business processes (Morisse and Prigge 2014). Communication between *geographically separated teams* represents the challenge of increased risk by long geographical distances between network actors. This can

also act as a barrier to communication between the participants (Alawamleh and Popplewell 2010). The process of *decision-making* can be negatively affected by the involvement of multiple actors in the cooperation. This can lead to a less efficient and subjective process with a lack of orientation towards the collaboration's goals (Morisse and Prigge 2014; Ruohomaa and Kutvonen 2008). *Achievement of operational alignment* describes the challenge of a missing alignment of the business processes between participants (Mueller et al. 2013). The challenge of *investment type selection* addresses the problem of making the right investment decisions in a business network situation (Mueller et al. 2013). *Lack of top management support and commitment* describes the missing strategic integration of the top management, which includes continuous contact among top executives to discuss wide-ranging goals and changes (Alawamleh and Popplewell 2010). With an increasing number of participants, also the number of *interorganizational connections* is increasing. This results in a variety of connections to multiple network actors which can negatively affect the organization's response time (Mueller et al. 2013; Konsynski and Tiwana 2004). The challenge of *equal access to information* covers the missing equality in access to information and data in the network for each network member (Morisse and Prigge 2014).

Research Approach

Based on the aim of this research and its qualitative and exploratory characteristics, the case study was selected as the research method. As it allows in-depth examination of contemporary events within its real-life context (Yin 2017). We extended our research into a multiple case study, which allows us to gather data from multiple horizontal interorganizational collaborations and increase the reliability of the results. Following Eisenhardt's (1989) case study model, we used multiple data collection methods (e.g., surveys and semi-structured interviews) and combined qualitative and quantitative data. At the same time, we follow the guidelines for conducting and reporting case study research in software engineering by Runeson and Höst (2009).

	Case study 1	Case study 2	Case study 3	Case study 4	Case study 5
Industry	Broadcasting	Broadcasting	Gambling	Banking	Broadcasting
Source of information	Semi-structured interview and observations	Semi-structured interview and observations	Semi-structured interview	Semi-structured interviews and protocols	Semi-structured interview
Collaboration form	Working group	Community of practice	Working group	Community of practice	Working group
Main collaboration goal	Basis for further collaboration	Reference architecture	Identify synergies	Reference architecture	Basis for further collaboration
Involved companies	13	4	10	>30	4

Table 1. Case Study Partners

Design and Plan: The main objective of this study is the identification of possible use cases for interorganizational BCMs in horizontal cooperation. To address this, we conducted a survey among EA experts and a multiple case study of five EA collaboration initiatives. In each initiative, the BCM was an essential part of the EA collaboration. Based on these insights, we further discuss its applicability of the BCM to address typical challenges occurring in interorganizational EA collaborations. In order to identify these challenges, we first conducted a comprehensive literature review, which we described in the previous section. In a second literature analysis, we further identified use cases for BCMs in single organizations. This list of potential use cases serves as a basis for the interviews we conducted in the next step. Since we are interested in "in-depth accounts of experiences and perceptions with individuals" (Cousin 2009), we conducted semi-structured interviews in the case studies. We enriched the results and extended our reach by conducting an online survey in professional networks (e.g., LinkedIn). The survey was published only in groups that focus on EA-related topics. Further, we were able to gather information from observations by attending some of the meetings of the case study partners.

Collect and Analyze: In total, we interviewed 16 experts from 5 interorganizational projects. Due to geographical distance, the interviews were conducted via phone or video call. We could observe the implementation and use of the BCMs in the first two case studies by attending the meetings. Three of the five case studies are internationally cooperating broadcasting companies from multiple European countries. Case study 3 and 4 are associations of organizations from the gambling and banking sector. The collaboration form in three case studies can be described as a working group with instructions and expectations from upper management. The companies in the remaining case studies form communities of practice to define reference architectures. Most of the interviewed experts are enterprise architects. Information on the case study partners is summarized in Table 1. The interviews were recorded, transcribed, and coded using the qualitative data analysis tool MAXQDA.

Evaluate and Conclude: By conducting the interviews one after the other, we could iteratively evaluate the proposed list of use cases identified in the literature. During the interviews, we could also identify new use cases resulting from the interorganizational context. The study findings reveal 19 possible use cases for interorganizational BCMs and present promising opportunities to address current challenges in EA collaborations.

Results

Although most of the case study partners are familiar with the usage of the BCM within their own organizations, the adoption for collaboration endeavors is in an early stage. This also underlines the novelty of this topic. In fact, the interviewed collaborations have about two years of experience with the BCM in the collaboration context. Some of the EA experts in our survey say that the coordination effort primarily hinders the implementation and use of a common BCM. Further mentioned impediments are the lack of acceptance by management and stakeholders and the dominating focus on business processes.

Use Cases for BCM in Horizontal Interorganizational Collaborations

The BCM can be incorporated into the enterprise architecture by mapping other models and objects to it (Ulrich and Rosen 2011; Bondel et al. 2018). These objects can be loosely coupled to business capabilities generating new insights and use cases. Hence, the BCM can act as a mediator between the different objects or aspects of an organization, such as applications or projects. Adapting these findings from the literature, we defined 5 major categories of use cases for BCMs. Each category is associated with the respective use case. The use cases are grouped into categories and are presented according to them.

To keep the online survey on a manageable scale, we focused on the categories of BCM usage only. The participants were asked what their companies use the interorganizational BCM for. The value in the last column of Table 2 reflects the 69 answers given by 21 participants. According to the survey, most of the participants use a common BCM for application portfolio management. Almost half of them use it to map projects or make business-related decisions. Based on these insights, we conducted semi-structured interviews to get more detailed information on the concrete use cases.

As a result. we could confirm the application of 11 existing use cases from the literature. Although these use cases originally come from research in a single organization context, we can say that they can also be adapted for usage in a horizontally collaborative environment. Further, we could identify 8 new use cases from the case studies. About half of the use cases are actively used in practice. However, most of the use cases identified in our research are evaluated as potentially possible in the future for the collaborations. In the following, we present the use cases identified for each case study partner which are listed in Table 2.

Strategy and business model mapping: This mapping represents the link between the collaboration's strategic requirements and business capabilities. In almost every case study the BCM was used as a tool to discuss the common business model. In some case studies this was the reason why the map was created:

"In working groups [...] the surface domain model didn't resonate well. It wasn't understood well, for business people. So that's where [...] a different viewpoint of the business from a business capability perspective [was created]." – Interviewee 13, Case study 4.

Further, new collaboration members can compare their BCM to the collaboration owned BCM to refine their understanding of their own and the common business. As already mentioned in the literature, the BCM can support outsourcing decisions in an interorganizational collaboration (Bakhtiyari et al. 2015).

Use Case	Case study 1	Case study 2	Case study 3	Case study 4	Case study 5	Survey
Strategy and business model mapping						43%
Business model understanding and development*	+	+	+	+	○	
Outsourcing decisions	○	-	-	-	○	
Organizational mapping						19%
Organizational structure clarification for mergers and acquisitions*	-	-	+	-	-	
Project mapping						43%
Project information and outcome	+	○	-	-	○	
Monitoring of running projects	○	-	-	-	○	
Identification of new projects	○	-	-	-	○	
Clarification of responsibilities	○	-	-	-	○	
Application portfolio mapping						57%
Application life cycle status	○	-	-	-	○	
Application support	○	-	-	-	○	
Capability spanning applications	○	○	-	-	○	
Cloud candidates	○	+	-	-	○	
Application landscape harmonization	+	-	+	-	○	
Infrastructure components	○	○	-	-	○	
Application functionality*	○	-	-	-	○	
Application development*	○	-	-	-	+	
Application procurement*	+	-	-	-	-	
Communication of application and technology standards*	○	-	-	-	○	
General use cases						29%
Language and vocabulary unification*	+	+	-	+	-	
Benchmarking*	○	+	-	-	○	
* = new use case, + = used, ○ = possible, - = not a use case						

Table 2. Identified Use Cases in Horizontal Interorganizational Collaborations

Organizational mapping: This category describes the link between the organizational structure, to business capabilities (Ulrich and Rosen 2011). The use case organizational structure clarification addresses the creation of an organizational chart from the business capability map and was used in the merger process of case study 3:

"So, what we're doing is we're integrating two autonomous organizational structures." –Interviewee 3, Case study 3.

The interviewees mentioned that it would reduce the problem and discussions involving organizational topics in the creation of the organizational chart. The BCM can also help to identify and capture the critical value creation potential of the acquisition target and communicate the to-be scenario of the acquisition (Toppenberg et al. 2015).

Project mapping: This mapping represents the possibility to map initiatives and projects to the BCM. This allows the involved companies to share information on implemented projects and their outcomes. This use case requires a high level of trust as we can observe in case study 1, where each organization maps their internal projects to the BCM to share success and failure for possible project adaption by other collaboration participants. However, collaboratively performed projects are not mapped to the BCM yet. This could create an overview of collaboration areas and potential areas for further collaboration. Once the collaboration project is set, the BCM can help to visualize the roles and responsibilities of each stakeholder and organization within the project.

Application portfolio mapping: BCMs are typically used as a tool for application portfolio management by mapping the supporting applications to each business capability (Aleatrati Khosroshahi et al. 2018). With 57%, this is also the most mentioned category of use cases by the survey participants. We could identify 6 use cases in the literature. Most of the interviewees agreed on the use cases in an interorganizational context:

"In this respect, application portfolio [mapping] is a bull's eye! In principle, this is the linchpin for business capabilities." – Interviewee 6, Case study 1.

Some of the use cases were even actually used. The status of the application life cycle and the assessment of its vendor support were classified as potentially possible by two use cases. The assessment of application landscape complexity, which is represented by the number of capability-spanning applications was a conceivable use case in three case studies. In the second case study, we could observe an information exchange on cloud computing. The involved organizations used the BCM to show the capabilities, in which they use or plan cloud technologies. Resulting from the collaboration aim, case study partners 1 and 3 use the BCM primarily to harmonize their application landscapes by identifying and consolidating the same applications. The assessment and comparison of infrastructure components is a possible use case but not performed yet. In addition to these use cases, we were able to identify four new use cases in the field of interorganizational application portfolio management. The comparison of application functionalities between organizations to uncover consolidation opportunities. The BCM can also be used to support collaborative application development as it is already applied in one of the case studies. Further, applications can be purchased together to reduce costs. In case study 1 the enterprise architects decided to introduce one common EA tool based on the common BCM. An interviewee from the last case study reported from a project, where they implement a BCM-based wiki to communicate application and technology standards to the stakeholders within the collaboration. They use the wiki also to assign responsibilities.

General use cases: Besides the topic-related use cases we could also identify two general use cases, which support the overall communication and operational process in interorganizational information exchange. By providing a unified language (e.g., English), barriers and possible misunderstandings in international projects can be reduced. The unambiguous definition of business capabilities provides a shared taxonomy and vocabulary even in initiatives with organizations sharing the same language. In the second case study, the BCM is used as a tool for benchmarks. To enhance participation and reduce the concerns regarding data sensitivity the provided information of the participants (e.g., used cloud technologies) is anonymized and published in form of a benchmark among the participants. This also motivates to play a part in the community of practice, since only participants which share information also receive the benchmark data.

Addressed Challenges in Horizontal Interorganizational EA Collaborations

We evaluated the identified challenges from the literature review with the case study partners to understand their relevance in the context of horizontal interorganizational EA collaboration and BCM support. The evaluation was conducted with 9 out of the 16 experts within the case studies 1, 3, and 5. The interviewees were asked whether they perceive each challenge in their collaboration and if the BCM can be used to resolve them. Figure 1 provides an overview of the challenges evaluated by the experts. The blue bars show the percentage of experts perceiving the respective challenge in their collaboration, whereas the orange bars show the assumption of the experts whether the BCM can help to address this specific challenge.

All challenges are perceived by at least one expert, which demonstrates the relevance of these challenges in horizontal interorganizational EA collaborations. The major challenges mentioned are ontology differences, heterogeneity and lack of standardization, lack of top management support and commitment, as well as failing communication and timely response. The experts agreed that it may be possible to address all

mentioned challenges with the help of a BCM. Based on the interviews, we identified specific use cases representing the application of an interorganizational BCM to resolve certain challenges. These use cases are listed on the right side of Figure 1 and linked to the respective challenge. A mapping was created if the description of the use case indicates a response to the challenge. However, the proposed mapping was created after the expert interviews and could therefore not be assessed by the experts.

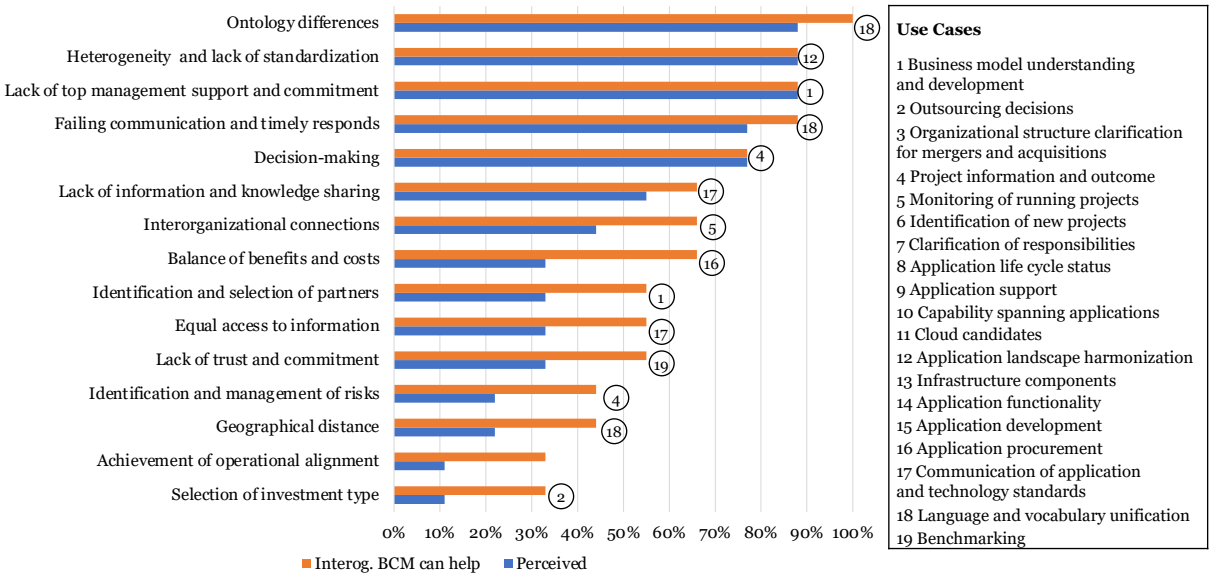

Figure 1. Addressed Challenges in Horizontal Interorganizational Collaborations

We could construct a mapping for 14 of the 15 challenges. Based on the strategic and project-oriented character of the BCM we could not find a suitable use case to address the operational alignment challenge in collaborations.

Ontology differences: The BCM can provide a shared vocabulary and language for diverse members. The ability to communicate efficiently is fundamental for collaborations between actors: *"This is precisely one of the most important points for me"* (Interviewee 2, case study 5). To do so, a common language and an understanding of basic concepts are needed. The BCM can provide this clarification by the general use case language and vocabulary unification.

Heterogeneity and lack of standardization: This challenge can be directly linked to the application landscape harmonization use case. The BCM allows a structured view of the application landscape enabling the comparison of applications at a business capability level. This baseline can be used to identify application harmonization potentials across organizations.

Lack of management support and commitment: This is not only a challenge in collaborations but also a major challenge for enterprise architects when using the concept of BCM in their own organization. However, the BCM is also a tool to enhance top management support. By visualizing the business models of horizontally cooperating companies, the management may derive strategic decisions.

Failing communication and timely response: The BCM can provide a common language and understanding for diverse members within an organization as well as a collaboration. A common understanding of terms creates clarity in the communication between all participants when discussing certain topics.

Decision-making: By providing a graphical representation of the common capabilities, the decision-making process can be improved in many ways. For instance, by giving an overview of active projects and outcomes, the BCM can provide a basis for strategic decisions.

Lack of information and knowledge sharing: This social challenge is difficult to overcome with only a BCM since it requires a certain mindset and the willingness to exchange information and knowledge. However, if these conditions are fulfilled, it is still possible to visualize information and knowledge with the help of

BCM. This is represented by use case 17 since it provides a platform to share such information and allows access to it. Also, participant-exclusive benchmarks can nudge organizations to take part by sharing information to compare, e.g., their application architecture with others.

Interorganizational connections: The BCM describes on a higher level what an organization does to achieve its business goals. By defining business capabilities, the organizations in the collaborations are encouraged to identify fields for collaborative projects archiving shared business goals. By mapping collaborative projects to the BCM an overview of areas with active collaboration can be visualized and further collaboration opportunities identified, such as collaborative application development.

Balance of benefits and costs: Projects and activities are usually accompanied by costs. Therefore, the costs must be eventually covered by the project outcome. By using the BCM organizations can identify possibilities for application landscape harmonization and with that reduce their IT costs. While legally possible, organizations can also identify capabilities where they can jointly procure applications by negotiating better terms.

Identification and selection of partners: This challenge can be linked to the category of "strategy and business model mapping". Analyzing and identifying the business model of the partner by collaboratively developing a BCM can be an indicator for further collaboration. Exchanging project information and outcome between the organizations can reveal common interests and projects.

Equal access to information: Not every participant has equal access to information in collaborations. Using a BCM-based wiki, each stakeholder would be able directly to retrieve the needed information or contact the person who is responsible for it.

Lack of trust and commitment: Especially in horizontal collaborations, where the participants usually act in the same industry, organizations are often very cautious and reserved. Since the BCM focuses on "what" an organization does, in its plain form it does not contain much sensitive information. By using the BCM as a tool for anonymized benchmarks, it can motivate organizations to participate.

Identification and management of risks: This challenge can be linked to the use case category project mapping. By identifying and tracking compliances in collaborative projects, risks can be evaluated. However, this is only one aspect of risks that can emerge in EAM collaborations.

Geographical distance: This challenge can be linked with the use case language and vocabulary unification. Geographically distributed teams communicating in different languages can apply this use case to reduce misunderstandings in their communication.

Selection of investment type: To support investment decisions in an association of organizations a common BCM can help, for instance in discussions regarding outsourcings. By highlighting the corresponding capabilities, the decision process can be streamlined.

However, it is unlikely that using a map alone will solve these challenges. The interorganizational BCM is rather a tool that supports communication and exchange among participating organizations and stakeholders.

Discussion

In this paper, we present 19 use cases of interorganizational BCMs in horizontal collaborations. The use cases are exemplarily mapped to recurring challenges in interorganizational EA cooperation to express their potential to address them. Thereby, we could answer the research questions, defined in the first section. We now discuss the key findings with reference to the research questions:

RQ 1: What are possible use cases for the BCM in horizontal interorganizational collaboration?

First, we investigated the use cases of BCMs in single organizations by conducting a literature review. Based on the results, we conducted an online survey and performed semi-structured interviews in five case studies to evaluate these use cases and identify new ones. Overall, we identified and explained 19 use cases for BCMs in a horizontal interorganizational collaboration context. 8 of these use cases are not prior documented in the scientific literature. Further, we elaborated which of the mentioned use cases are already implemented or potentially used by the experts in their collaboration. Currently, 9 use cases are identified in practice. In general, we can say that the intended usage mainly depends on the collaboration's objectives

and setting. But in almost every case study the BCM was used as a tool to unify language and taxonomy and to compare and understand the common business. The first case study further uses the BCM to compare ongoing projects and application landscapes. They also identify opportunities for collaborative application procurement. In case study 5 the BCM provides an overview of collaborative application development, whereas case study 2 uses the BCM to conduct benchmarks in the field of cloud technologies. Case study 3 uses the BCM primarily to analyze organizational structures for mergers and acquisitions. While our findings strengthen the body of knowledge in the field of interorganizational EAM, we are not aware of any related work that contradicts our findings.

RQ 2: What are recurring challenges in interorganizational EA collaborations, and can the BCM address them?

In order to answer the first part of this RQ, we conducted a comprehensive literature review to identify common challenges in interorganizational EA cooperation. As a result, we present 15 challenges, which were evaluated during the multiple case study by the experts. For the second part, we investigated whether the BCM can help to resolve these challenges. The findings show that 14 of 15 challenges can be addressed by the identified use cases (Figure 1). Most of the interviewees perceive social issues like ontology and communication differences and architecture-related issues like lack of standardization. But they also see significant potential in an interorganizational BCM as a tool to address these challenges.

Limitation

There are typical limiting factors for case study research such as validity, generalizability, and reliability (Runeson and Höst 2009). To avoid threats of validity, we conducted a multiple case study involving and interviewing experts from different companies. By considering various industries with different collaboration goals and settings, we also address generalizability. However, we focus on horizontal collaborations only. In order to ensure reliability, the previously defined interview guideline and the survey were reviewed by a second researcher. As interviews with individuals are always subjective, it would be advantageous to conduct more interviews and case studies to improve the objectivity of the results. The majority of the use cases are classified as potentially useful but are not implemented yet. This can be traced back to the early state of BCM in the observed collaborations.

Conclusion and Future Work

Motivated by increasing collaborations in the field of EAM, we investigated the current status of BCMs in a horizontal interorganizational context. Following the RQs, we could identify and evaluate potential use cases in this environment. For this purpose, we conducted two literature reviews to identify recurring challenges in interorganizational EA collaborations and current use cases of BCMs applied in single organizations. To verify the suitability of these use cases for horizontal interorganizational collaborations, we conducted an online survey among EA experts and a multiple case study with semi-structured interviews. During the interviews, we could identify 8 new use cases and confirm the potential usage of 11 use cases. We have also noticed that the implemented use cases strongly depend on the collaboration's goal and setting. In the next step, we showed that the identified challenges also apply to horizontal collaborations and that BCMs can directly or indirectly help to address them. We could propose at least one use case for 14 challenges that emphasize the importance of business capabilities in horizontal interorganizational context and motivates for future investigations.

Based on these results, future studies can be conducted on further collaboration forms and dimensions. As the maturity of the BCM in each collaboration grows, it increases the knowledge about potential use cases. Further application scenarios can come with progressing time.

REFERENCES

Alawamleh, M., and Popplewell, K. 2010. “Risk sources identification in virtual organisation,” in *Enterprise Interoperability IV*, London: Springer-Verlag, pp. 265-277.

Aleatrati Khosroshahi, P., Hauder, M., Volkert, S., Matthes, F., and Gernegroß, M. 2018. “Business capability maps: Current practices and use cases for enterprise architecture management,” in *Proceedings of the 51st Hawaii International Conference on System Sciences*.

Bakhtiyari, A. R., Barros, A., and Russell, N. 2015. "Enterprise architecture for business network planning: A capability-based approach," in *International Conference on Advanced Information Systems Engineering*, Springer, Cham, pp. 257-269.

Fleischer, J., Herm, M., and Ude, J. 2007. "Business Capabilities as configuration elements of value added networks," *Production Engineering*, 1(2), pp. 187-192.

Bondel, G., Faber, A., and Matthes, F. 2018. "Reporting from the implementation of a business capability map as business-IT alignment tool," in *22nd International Enterprise Distributed Object Computing Workshop (EDOCW)*, IEEE, pp. 125-134.

Chopra, S., and Sodhi, M. S. 2004. "Supply-chain breakdown," *MIT Sloan management review*, 46(1), pp. 53-61.

Cousin, G. 2009. *Researching learning in higher education: An introduction to contemporary methods and approaches*, New York: Routledge.

Drews, P., and Schirmer, I. 2014. "From enterprise architecture to business ecosystem architecture: Stages and challenges for extending architectures beyond organizational boundaries," in *18th International Enterprise Distributed Object Computing Conference Workshops and Demo.*, IEEE , pp. 13-22.

Eisenhardt, K. M. 1989. "Building theories from case study research," *Academy of Management Review,* 14(4), pp. 532-550.

Goel, A., Schmidt, H., and Gilbert, D. 2009. "Towards formalizing virtual enterprise architecture," in *13th Enterprise Distributed Object Computing Conference Workshops*, IEEE, pp. 238-242.

Konsynski, B., and Tiwana, A. 2004. "The improvisation-efficiency paradox in inter-firm electronic networks: governance and architecture considerations,". *Journal of Information Technology*, 19(4), pp. 234-243.

Moore, J. F. 1996. *The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems*, New York: HarperBusiness.

Morisse, M., and Prigge, C. 2014. "Business continuity in network organizations–a literature review, " in *20th Americas Conference on Information Systems*, Savannah.

Mueller, T., Schuldt, D., Sewald, B., Morisse, M., and Petrikina, J. 2013. "Towards Inter-Organizational Enterprise Architecture Management - Applicability of Togaf 9.1 for Network Organizations," in *Proceedings of the 19th Americas Conference on Information Systems*, Chicago.

Provan, K. G., and Kenis, P. 2008. "Modes of network governance: Structure, management, and effectiveness," *Journal of public administration research and theory*, 18(2), pp. 229-252.

Runeson, P., and Höst, M. 2009. "Guidelines for Conducting and Reporting Case Study Research in Software Engineering," *Empirical software engineering* (14:2), p. 131.

Ruohomaa, S., and Kutvonen, L. 2008. "Making multi-dimensional trust decisions on inter-enterprise collaborations," in *3rd International Conference on Availability, Reliability and Security*, IEEE, pp. 873-880

Sherehiy, B., Karwowski, W., and Layer, J. K. 2007. "A review of enterprise agility: Concepts, frameworks, and attributes," *International Journal of industrial ergonomics*, 37(5), pp. 445-460.

Simatupang, T. M., and Sridharan, R. 2002. "The collaborative supply chain," *The international journal of logistics management*, 13(1), pp. 15-30.

Toppenberg, G., Henningsson, S., and Shanks, G. 2015. "How Cisco Systems used enterprise architecture capability to sustain acquisition-based growth," *MIS Quarterly Executive*, 14(4), pp. 151-168.

Ulrich, W., and Rosen, M. 2011. "The business capability map: the "rosetta stone" of business/it alignment," *Cutter Consortium, Enterprise Architecture*, 24(4).

Webster, J., and Watson, R. T. 2002. "Analyzing the past to prepare for the future: Writing a literature review," *MIS quarterly*, xiii-xxiii.

Westphal, I., Thoben, K. D., and Seifert, M. 2007. "Measuring collaboration performance in virtual organizations," In *Working Conference on Virtual Enterprises*, Boston: Springer, pp. 33-42.

Yilmaz, F., Akdemir, D., and Matthes, F. 2020. "Why would enterprise architects work together? - A multiple case study," in *26th Americas Conference on Information Systems*, Virtual.

Yilmaz, F., Feldmeier, F., and Matthes, F. 2021. "Deriving a Process for Interorganizational Business Capability Modeling through Case Study Analysis," in *23rd International Conference on Enterprise Information Systems (ICEIS)*.

Yin, R. K. 2017. *Case Study Research and Applications: Design and Methods*, Los Angeles: Sage publications.

Application of Interorganizational Business Capability Maps in Different Forms of Horizontal Enterprise Architecture Collaboration

Fatih Yılmaz
Department of Informatics
Technical University of Munich
Munich, Germany
fatih.yilmaz@tum.de

Florian Matthes
Department of Informatics
Technical University of Munich
Munich, Germany
matthes@tum.de

***Abstract*—In today's business environment, organizations are continuously confronted with increasing dynamics in the market by competitors introducing new business models or using disruptive technologies to gain advantage. To remain competitive, practitioners and scientists have recognized the relevance of collaboration between organizations in terms of business but also in terms of IT. Centralized top-down enterprise architecture management (EAM) methods have to be adapted in order to support this trend. But empirical studies investigating the introduction and use of interorganizational enterprise architecture (EA) artifacts in this context are still rare. Therefore, we conducted a multiple case study of six EA collaboration initiatives using interorganizational business capability maps (BCM). Based on the results of 12 semi-structured interviews, we categorize and present the goals and use cases in two different forms of horizontal EA collaboration.**

***Index Terms*—enterprise architecture, business capability map, interorganizational, collaboration, multiple case study**

I. Introduction

In the past few years, companies used to focus on their core competencies and tried to avoid unnecessary cooperation with competitors. In many industries, this silo mentality has negatively affected the organization's existing business model and slowed down the process of digitalization [1]. In order to remain competitive organizations realized that they are forced to strengthen their relationship with other companies. By shifting from competition to coevolution with customers, suppliers, investors, and competitors the organizations must adapt their business models to the environment in which they operate as a whole ecosystem [2]. However, the increasingly complex ecosystem of companies makes it difficult to manage the multitude of interconnected business processes and a variety of stakeholders [3].

Since the business processes of companies are increasingly intertwined with their IT services, organizations have also to coordinate their IT systems to cooperate more effectively [4]. In order to manage the increasing complexity of systems communicating across the organization's boundaries, the concept of interorganizational enterprise architecture management (EAM) has gained interest from practitioners and scientists. The field of research ranges from IT systems interoperability [5] to interorganizational business process management [6] to collaborative EAM [4], [7], [8]. This illustrates the broad scope of this research area and reflects the general interest of researchers in topics related to interorganizational collaboration.

Being an essential tool for enterprise architects, business capability maps (BCM) provide a holistic view of the organization including its core business capabilities. They are used as a tool to communicate with different stakeholders and often serve as a basis for discussions with the management. By mapping business and IT components to the respective business capability, targeted visualizations are created. This allows dependencies to be uncovered and recommendations for action to be made [9]. Even though the concept of BCMs was originally developed for the use within a single organization, its interorganizational application is increasingly being discussed and investigated in recent research [10], [11].

Especially when organizations from the same industry cooperate with each other, as is the case with horizontal collaboration, the development and use of a common BCM seem to be evident [12]. Since these companies collaborate in the same parts of their value chain, they have similar business capabilities. By visualizing the capabilities in form of a BCM, the organizations can use it as a communication tool within the collaboration [11].

Even though literature on EA collaborations and interogranizational BCMs already exist, extant literature does not address the relationship between collaboration objectives and BCM use cases in different forms of horizontal EA collaboration. We aim to fill this gap by raising the following research question:

How do the form and underlying goals of horizontal enterprise architecture (EA) collaboration affect use cases for interorganizational business capability maps (BCM)?

II. Theoretical Background and Related Work

During our research, we could identify several papers comprising the idea of interorganizational EA. Even if the authors use different terms, such as extended EA [4], interenterprise

- accepted version -

[8], or interorganizational architectures [13], each form addresses the issue of extending or using EA methods beyond a single organization's boundaries.

Conducting a multiple case study, Drews and Schirmer [4] present a five-stage process from EA to an interorganizational business ecosystem architecture. They propose that EA should consider the complex environment beyond organizational boundaries and extent their architecture according to a business ecosystem perspective. They identify challenges of EA from a business ecosystem perspective by conducting four case studies in different industries. These challenges have been classified into four categories, namely modeling extended EA and business ecosystem architecture, tools, management, and socio-technical. Further, they propose the five stages of interorganizatinoal EA to address the identified challenges. These consist of EA, extended EA, federated or collaborative network architecture, focused business ecosystem architecture, and business ecosystem architecture. Each stage differs in the involved stakeholders and the degree of connection regarding architecture and applications. The first stage defines the EA for a single company. The second stage incorporates further stakeholders such as customers, partners, and suppliers. This stage constitutes the extension of EA. The third stage is named federated or collaborative network architecture. In this stage, the actors share information of their EA like interfaces and artifacts. This leads to the improvement of shared initiatives. The last stage focuses on the whole ecosystem and is referred to as the business ecosystem architecture.

Based on a literature review Mueller et al. [7] have extracted several challenges of interorganizational EAM which they categorized into six types: governance, infrastructure and application integration, process and data integration, organization of network organization, social issues, and strategy. Further, they used The Open Group Architecture Framework (TOGAF) version 9.1 to address these challenges. By applying the framework to cope with these challenges they analyzed whether TOGAF is suitable for network organization. The results show that TOGAF 9.1 can address some of the identified challenges. However, it does not yet provide support especially for challenges concerning the organization of network organization. Therefore, Mueller et al. [7] take the view that the existing TOGAF framework needs to be extended.

Vargas et al. [8] present in their paper the concept of interenterprise architecture. With this term, they want to fill the gap between three areas: strategic alignment, EA, and enterprise collaboration. In order to improve the alignment of information and communication technologies and business processes, they adapt methodologies and tools from a single organization EA to an interorganizational context. They emphasize supply chains and networks as two forms of collaboration, where this type of interenterprise architecture is adaptable. Moreover, Vargas et al. [8] present a conceptual model of interenterprise architecture, which includes a seven-step collaboration process, a strategic alignment model, and elements of the EA. In further work, they present a comprehensive framework of interenterprise architecture (FIEA) including modeling views (business, organization, resources, process, knowledge, and IS/IT based on the internet), life cycle phase (creation, conceptualization, definition, operation, evolution, and dissolution) and modeling detail level (general, partial, and particular).

Based on the defined research questions, we further have identified literature addressing the objectives of EA collaborations. As a result of a multiple case study, Yilmaz et al. [13] describe the motivation for enterprise architects to collaborate with architects from other organizations. By conducting semi-structured interviews, they could identify eight different objectives of interorganizational EAM. However, by interviewing 13 enterprise architects in only two case studies, the results may lack in reliability. The authors already pointed to this fact and proposed to conduct further case studies. We followed this recommendation and extended this research by conducting four more case studies.

As a second part of the research question, we looked for literature addressing the use of business capabilities in an interorganizational context. But we noticed that the field of collaboratively used BCMs is relatively underexplored with limited research conducted. Bakhtiyari et al. [10] present a capability-based approach for EA to plan business networks. They present novation requirements in order to identify correspondences between organizations in a business network. These requirements are supported by a global BCM which acts as a link between business capabilities and organizations.

Fleischer et al. [14] propose to use business capabilities "as configuration elements of value added networks". By creating a BCM, the business capabilities of the individual nodes are compared and mapped to the nodes of the network. This allows the configuration, arrangement, and evaluation of value-added networks. As a result, each individual node within the network can be managed.

During the literature review, we could find only papers presenting single interorganizational usage scenarios for BCMs. In contrast, Yilmaz et al. [11] have created a holistic view on use cases for interoganizational BCM in horizontal collaboration. By conducting semi-structured interviews in five case studies, they present a list of 19 potential use cases for interorganizational BCMs. Each use case is categorized in clusters, such as application portfolio mappings. They classified the use cases as already actively used in practice and potential use cases which are not been observed in practice yet. During our investigations, we were able to extend the list of practical use cases by three new ones.

Even though we could find recent research on each topic, none of the literature displays the dependency of the collaboration purpose and relevant use cases of an interorganizational BCM. This review of related work provides the foundation for our contribution.

III. Research Approach

Based on the research question and the study's qualitative and exploratory characteristics, the case study was selected as the applied research method. As it allows in-depth examination

TABLE I
OVERVIEW OF CASE STUDIES

	Case study 1	Case study 2	Case study 3	Case study 4	Case study 5	Case study 6
Industry	Broadcasting	Broadcasting	Gambling	Banking	Broadcasting	Health
Supply chain direction	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal
Collaboration constellation	Under organizational control	Self-organized	Under organizational control	Member-owned	Under organizational control	Under organizational control
Basis of relationship	Ongoing	Practice-based	Ongoing	Expertise and practice-based	Ongoing	Ongoing
Temporal scale	Long term	Long term	Long term	Long term	Long term	Long term
EA collaboration form	Working group	Community of practice	Working group	Community of practice	Working group	Working group
Number of organizations in the collaboration	13	6	10	> 30	4	> 30
Source of information	Semi-structured interviews and observations	Semi-structured interviews and observations	Semi-structured interviews	Semi-structured interviews	Semi-structured interview	Semi-structured interview

of contemporary events within their real-life context [15]. We extended our research into a multiple case study, which allows us to gather data from multiple horizontal interorganizational collaborations and increase the reliability of the results. At the same time, we follow the guidelines for conducting and reporting case study research in software engineering by Runeson and Höst [16]. Since we "aim to understand common perceptions and experiences among a group of relatively homogeneous individuals" [17], we followed the recommendation of Guest et al. by interviewing 12 EA experts.

A. Design and Plan

The main objective of this study is the demonstration of dependencies between the objectives of EA collaboration and the associated use cases for interorganizational BCMs in horizontal cooperation. To address this, we have conducted a multiple case study of six EA collaboration initiatives. In each initiative, the BCM is an essential part of the EA collaboration and was even developed within the collaboration. Since we are interested in "in-depth accounts of experiences and perceptions with individuals" [18], we have conducted semi-structured interviews in the case studies. Further, we were able to gather information from observations by attending some of the meetings of the case study partners.

In order to keep the results of the study as general as possible, we have studied case studies from different industries. Namely, broadcasting, banking, gambling, and health. The collaboration direction regarding the supply chain in each case study is horizontal. This means, they are "unrelated or competing organizations cooperate to share their private information or resources" [12].

Based on previous research conducted in this field [11], we reasonably believe that the collaboration aim in EA initiatives mainly depends on the collaboration form. Therefore, we followed the collaboration constellation scheme presented by Kietzmann et al. [19] to classify the case studies. Based on the collaboration characteristics "collaboration constellation", "basis of relationship", and "temporal scale", we could assign the case studies in two collaboration forms within their EA activities: "Working group" and "community of practice". Even though each organization in our case studies is largely independent, the collaboration in some case studies is "under organizational control". This means that the EA collaboration is fostered by common top management as is the case with case study 1, 3, 5, and 6. In these case studies, the basis of the relationship for collaboration is the ongoing collaboration not only in the field of EAM but on various IT and business-related topics. The EA collaboration in case study 2 is self-organized by enterprise architects from six different broadcasting companies working together on the development and use of a common BCM. Case study 4 consists of more than 30 organizations from the banking industry. As an independent, non-profit association they collaboratively develop and promote architectural frameworks. The collaboration is based on the participants' professional expertise and is focused on the domain of developing architectural frameworks for the banking industry. The EA collaboration in each case study is set for the long term. Following the classification of Kietzmann et al. [19], we can classify the case studies 1, 3, 5, and 6 as working groups [20], [21]. Characterized by their independence and practice-based relationships, the remaining case studies can be classified as communities of practice [22], [23]. The characteristics and general information on the case study partners are summarized in Table I.

B. Collect and Analyze

Due to the exploratory nature of this research, we decided to mainly conduct semi-structured interviews. In total, we interviewed 12 people. Most of the interviewees were enterprise architects. Nevertheless, each interviewee was familiar with the concept of EA and business capabilities. The interviewee's experience in this field ranges from 1 to more than 10 years. The average interview duration was 58 minutes. The list of interviewees is summarized in Table II. Due to geographical distance, the interviews were conducted via phone or video call. We could observe the implementation and use of the BCMs in the first two case studies by attending some of the meetings.

TABLE II
OVERVIEW OF INTERVIEWED EXPERTS

Case study	Role	EAM experience	Interview duration
1	Enterprise architect	6-10 yrs	01:00 hrs
1	Enterprise architect	1-2 yrs	00:53 hrs
2	Enterprise architect	6-10 yrs	00:57 hrs
2	Head of metadata	$>$ 10 yrs	01:13 hrs
3	Head of strategy	1-2 yrs	00:36 hrs
3	Head of department	$>$ 10 yrs	00:42 hrs
4	Executive director	$>$ 10 yrs	01:05 hrs
4	Enterprise architect	$>$ 10 yrs	01:05 hrs
4	Business architect	$>$ 10 yrs	01:05 hrs
4	Enterprise architect	$>$ 10 yrs	01:05 hrs
5	Business analyst	6-10 yrs	01:15 hrs
6	Enterprise architect	$>$ 10 yrs	00:35 hrs

During the interviews, we asked the experts for general information about the EA collaboration to define the collaboration constellation. In the next step, we talked about the objectives of the EA collaboration and the use cases for the collaboratively developed BCM. The interviews were recorded, transcribed, and coded using the qualitative data analysis tool MAXQDA.

C. Evaluate and Conclude

We could iteratively evaluate the proposed list of objectives and use cases by conducting the interviews one after the other. As a result of the interviews, we could reveal distinct EA collaboration objectives and BCM use cases for working groups and communities of practice. Further, we could confirm existing objectives and BCM use cases from the literature and identify new ones. The study findings reveal eight EA collaboration objectives for working groups and three for communities of practice. We could observe ten use cases for the interorganizational BCM in working groups and four in communities of practice.

IV. RESULTS

In this paper, we enrich the results of previous case studies [11], [13] by conducting 12 further interviews with EA experts and including a case study from the health industry. However, more importantly, we combine the results to generate new insights with regard to the relevant objectives and BCM use cases in different EA collaboration forms. The combined results are summarized in Table III.

Driven by the requirements of joint management, one of the main objectives of the collaboration in case study 1 was to identify potential cost savings in IT through targeted collaboration. One interviewee told us that in order to achieve this goal, the potential for collaboration would first have to be identified using a proven method.

Consequently, the decision was made to use an interorganizational BCM. This creates a common language to sharpen the common understanding of business and IT. Concrete use cases include the sharing of information on joint projects, the harmonization of the application landscape, and the joint acquisition of applications in the appropriate capabilities. In addition to the collaborative aspects, the cooperation also serves to evaluate and further develop concepts developed in-house. Thus, the participating enterprise architects have the opportunity to further develop their internal business capability maps and architecture principles.

As a collective of volunteer participants, the goal of case study 2 is primarily BCM-oriented. Nevertheless, they are interested in exchanging experiences with enterprise architects from other companies. Similar to the first case study, the participants are interested in evaluating and extending their internal EA models through the exchange of information. As the only case study, they use the BCM to conduct benchmarks among participants. By assigning anonymized data on the use of cloud technology to the business capabilities, information on the use of software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS) in the broadcasting industry is revealed.

The EA initiative in the case study 3 primarily serves to create comparability and adaptability between two independent business units. The ”horizontal merger process” (Interviewee 5, case study 3) is to be supported by suitable EAM methods collaboratively developed by architects of both business units. In addition to creating transparency at the organizational level, the aim is also to identify cost-saving potential in the long term. The head of strategy described the BCM use case related to clarification of organizational structure as follows:

”We have a human resources (HR) department in [business unit 1], centrally managed HR, and HR in [business unit 2]. Who will do what [in the future]? So that’s where the BCM helps us.” - Interviewee 5, case study 3

Furthermore, BCM also serves to create a common understanding of the business and helps to harmonize the application landscape.

In case study 4, EA experts from different banks have joined forces to create universally applicable architectural models for the banking industry:

”Because the model [which we develop] is an industry reference.” - Interviewee 7, case study 4

They continuously develop new methods and models to create a common language and to deepen business and IT understanding. This is how BCM came to be the successor to an existing model:

”The service domain model wasn’t understood well, by business people. [...] So that’s where a number of people got together and said, we need to get a different viewpoint of the business: From a business capability perspective!” - Interviewee 7, case study 4

The case study 5 has the same constellation in its collaboration structure as case study 1 and is also active in the broadcasting industry. The aim of the collaboration is to identify cost-saving potentials and joint projects. As one interviewee told us, the BCM is used for joint development and functional extensions of applications:

”In other words: Joint application development! That you look at business capabilities and then jointly develop applica-

TABLE III
OVERVIEW OF COLLABORATION AIMS AND BCM USE CASES IN PRACTICE

Case study 1	
EA collaboration form	Working group
EA collaboration aims	• Identification of cost-saving opportunities [13] • Ensure comparability and adaptability [13] • Improvement of own developed concepts [13] • Identification and support of cooperation projects [13] • Establishment of an industry-wide reference model [13] • Establishment of a common EAM methodology [13] • Development of a common application landscape [13] • Encourage exchange and communication between organizations [13]
BCM use cases in practice	• Business model understanding and development [11] • Project information and outcome [11] • Application landscape harmonization [11] • Application procurement [11] • Language and vocabulary unification [11]
Case study 2	
EA collaboration form	Community of practice
EA collaboration aims	• Improvement of own developed concepts [13] • Establishment of an industry-wide reference model [13] • Encourage exchange and communication between organizations
BCM use cases in practice	• Business model understanding and development [11] • Visualization of cloud candidates [11] • Language and vocabulary unification [11] • Benchmarking tool [11]
Case study 3	
EA collaboration form	Working group
EA collaboration aims	• Identification of cost-saving opportunities • Ensure comparability and adaptability
BCM use cases in practice	• Business model understanding and development [11] • Organizational structure clarification for mergers and acquisitions [11] • Application landscape harmonization [11]
Case study 4	
EA collaboration form	Community of practice
EA collaboration aims	• Establishment of an industry-wide reference model • Encourage exchange and communication between organizations
BCM use cases in practice	• Business model understanding and development [11] • Language and vocabulary unification [11]
Case study 5	
EA collaboration form	Working group
EA collaboration aims	• Identification of cost-saving opportunities • Identification and support of cooperation projects
BCM use cases in practice	• Application development [11]
Case study 6	
EA collaboration form	Working group
EA collaboration aims	• Ensure comparability and adaptability • Identification and support of cooperation projects • Establishment of an industry-wide reference model • Encourage exchange and communication between organizations
BCM use cases in practice	• Business model understanding and development • Application development • Communication of application and technology standards • Language and vocabulary unification • Management communication tool • Monitoring the impact of new regulations on business and IT

tions if any are needed. Or you develop new functions together or extend them." - Interviewee 11, case study 5

The last case study partner in our research comes from the healthcare industry and is set up as an EA working group. However, they pursue less the goal of cost reduction. Their goal is primarily to create comparability among participants and support collaboration. For this purpose, an industry-wide reference model was created in the form of an interorganizational BCM. The benefits of a common BCM were summarized in an interview as follows:

"The top management doesn't want to see the kind of technical details, but they want to understand how things work at a very high level, at the business level." - Interviewee 12, case study 6

In addition to use cases already known from previous case studies, such as the creation of a common understanding for business and IT and the joint development of applications, we were able to identify three new use cases in practice for interorganizational BCM in this case study: Use as a management communication tool, communication of application and technology standards, and monitoring the impact of new regulations on business and IT. Some of these use cases were described in the interview as follows:

"So this capability mapping and models are quite useful tools to show how new regulations or big changes will affect some business capability areas. [Further], it's a template on how to copy standard systems and how to integrate new members." - Interviewee 12, case study 6

When analyzing the interviews, we noticed that the BCM use cases depend on the collaboration goals. These in turn are influenced by the form of EA collaboration. The only common feature of the case studies is the horizontal collaboration direction in their supply chains (Figure 1). In the following subchapters, we will therefore summarize the EA collaboration aims and BCM use cases in each EA collaboration form.

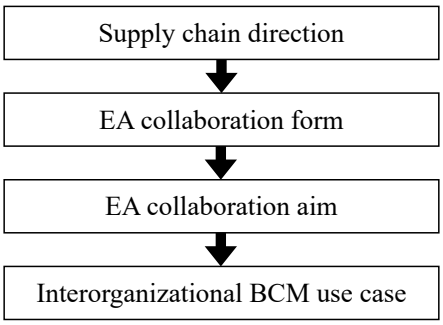

Fig. 1. Overview of classification steps.

A. EA collaboration aims and BCM use cases in working groups

Following the classification procedure illustrated in Figure 1, we have summarized the collaboration goals of working groups and related them to the relevant use cases of the interorganizational BCM. This step-by-step mapping is preceded by the collaboration direction in the supply chain. An overview of this nesting and results is shown in Figure 3. The illustration, which is based on a morphological box, is to be read from left to right.

Starting with the collaboration direction related to the value chain, we observed exclusively horizontal relationships in our study. This means that the organizations collaborate in the same or similar value chain segments. Consequently, the companies' products and services are similar to each other or the same. Which may make them even competitors acting in the same industry [12], [24]. In contrast to horizontal cooperation, vertical cooperation would involve collaboration at different parts of the value chain. We have not investigated this form of collaboration which usually follows a customer-supplier relationship [12], [24]. However, a combination of both collaboration directions is also possible [25]. The different collaboration directions are illustrated in Figure 2.

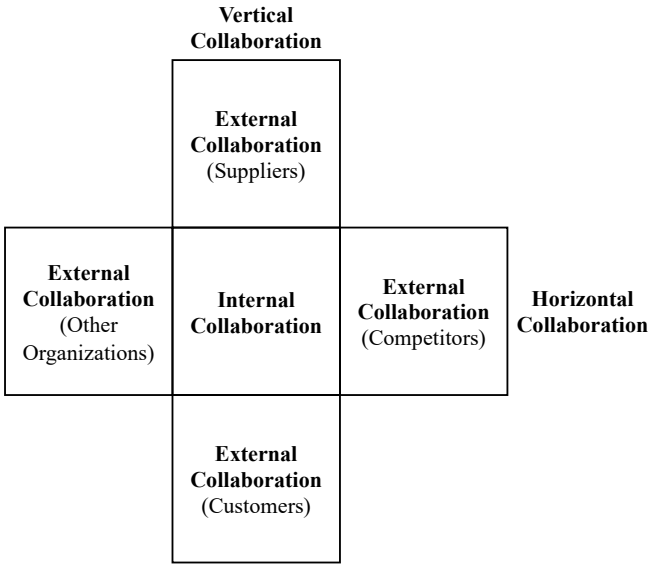

Fig. 2. Collaboration directions related to the value chain [24].

We determined the collaboration form in the interorganizational EA initiatives based on various characteristics according to Kietzmann et al.'s classification scheme [19]. Thus, four of the six case studies can be classified as a "working group". This represents the second step in the assignment process of the collaboration form, goals, and the associated BCM use cases (Figure 1).

In summary, we can say that a working group can pursue all collaboration goals identified in previous literature [13]. In almost all case studies belonging to the working group, the goals of the collaboration are to uncover cost-saving potentials and to create comparability and adaptability. More than half of the case studies want to identify and support further collaboration projects through a joint EA initiative. To this end, a common EAM methodology and an industry-wide reference

Supply chain direction	EA collaboration form	EA collaboration aim	Interorganizational BCM use case
Horizontal	Working group	Identification of cost-saving opportunities	Strategy and business model mapping
			Business model understanding and development
		Ensure comparability and adaptability	Organizational mapping
			Organizational structure clarification for mergers and acquisitions
		Improvement of own developed concepts	Project mapping
			Project information and outcome
		Identification and support of cooperation projects	Application portfolio mapping
			Application landscape harmonization
			Application development
			Application procurement
			Visualization of cloud candidates
			Communication of application and technology standards *
	Community of practice	Establishment of an industry-wide reference model	General use cases
			Language and vocabulary unification
		Establishment of a common EAM methodology	Benchmarking tool
			Management communication tool *
		Development of a common application landscape	Monitoring the impact of new regulations on business and IT *
		Encourage exchange and communication between organizations	

* new use case in practice

Fig. 3. Overview of EA collaboration aims and BCM use cases in a working group.

model are to be developed. As a very concrete goal, working groups want to develop a common application landscape in the future. Nevertheless, participating organizations also have an interest in further developing their own models that they use in the company.

In all the case studies we have examined, the jointly developed BCM plays a major role. The EA collaborations use it specifically to achieve their collaboration goals. Through the semi-structured interviews, we were able to confirm and extend the findings of previous work [11]. For example, almost every working group uses the shared BCM to build and extend the common understanding of their business. BCM is seen as a special use case in the context of a merger and acquisition process to create organizational clarity during and after the merger process. Many working groups, on the other hand, used BCM for mapping projects and applications. Especially the joint mapping of applications and the resulting opportunities were seen as an option to reduce joint costs. Joint procurement and development of applications is another way to reduce joint costs. A use case observed for the first time in practice is the use of BCM to communicate application and technology standards. Another use case that does not appear in this way in the literature is the use of BCM as a communication tool with management. Based on the horizontal cooperation direction, the cooperating companies are all affected by similar or the same regulations. We observed that BCM is used as a framework to monitor the impact of new or changing regulations on the business and IT landscape.

B. EA collaboration aims and BCM use cases in communities of practice

During our investigation, we found out that two of the six case studies are formed as a ”community of practice”. We determined the classification based on the collaboration characteristics of the case studies. One important characteristic is the ”fundamentally informal and self-organizing” [26] nature of the collaboration and the participating organizations. The community of practice is defined as follows: ”Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis” [27]. This definition of the community of practice includes three elementary building blocks. These are domain, practice, and community.

The term domain refers to the section ”share a concern, a set of problems, or a passion about a topic” in the definition and comprises the common problem or interest of the participants. It is also the reason why participants come together [26]. Therefore, it seems natural that some interviewers mentioned ”developing an industry-wide model” as a goal of the collaboration. This refers to the part of ”[being] passion about a topic” in the definition of the community of practice.

Supply chain direction	EA collaboration form	EA collaboration aim	Interorganizational BCM use case
Horizontal	Working group	Identification of cost-saving opportunities	Strategy and business model mapping
			Business model understanding and development
		Ensure comparability and adaptability	Organizational mapping
			Organizational structure clarification for mergers and acquisitions
		Improvement of own developed concepts	Project mapping
			Project information and outcome
		Identification and support of cooperation projects	Application portfolio mapping
			Application landscape harmonization
			Application development
			Application procurement
	Community of practice	Establishment of an industry-wide reference model	Visualization of cloud candidates
			Communication of application and technology standards *
		Establishment of a common EAM methodology	General use cases
			Language and vocabulary unification
		Development of a common application landscape	Benchmarking tool
			Management communication tool *
		Encourage exchange and communication between organizations	Monitoring the impact of new regulations on business and IT *

* new use case in practice

Fig. 4. Overview of EA collaboration aims and BCM use cases in a community of practice.

The second structural element is called practice. It describes the shared knowledge and expertise of the group, which is deepened and extended by learning from each other. Therefore, the participants are in an environment ”where it is safe to ask hard questions and speak the truth” [27].

The final element of the community of practice is the actual community. This aspect ”denotes a set of interpersonal relationships arising out of people’s mutual engagement in learning through practice [28]”. Nevertheless, the community of practice also has its limitations, which restrict the scope of this form of collaboration [29].

Despite the community mindset, we noticed in the interviews that some participants also have self-serving goals. For example, one reason for participating is the further development of the own organization’s EA models by presenting and discussing them in the community. But also, the goal of increased exchange between individuals and organizations, which is typical for collaborative forms, plays a major role.

In total, we could identify four relevant use cases for interorganizational BCMs in the communities of practice. Just like the working group, participants of communities of practice would like to deepen and broaden the common understanding of the business by using interorganizational BCMs. The main use case for case study 2 was, for instance, the use of BCM to create anonymized benchmarks. The benchmarks are intended to survey the use of cloud technologies in the respective business capabilities. In addition to the current use, information on the planned use of the various cloud technologies is also collected. As the last use case in communities of practice, we could identify the general use case ”language and vocabulary unification”. The collaboration goals of a community of practice and the relevant use cases of an interorganizational BCM are summarized in Figure 4.

V. Discussion

By conducting 12 semi-structured interviews in six case studies and partly observing the collaborative meetings by attending them, we could identify two different forms of collaboration, eight collaboration goals, and 12 use cases for interorganizational BCM. We now want to reflect and discuss the key findings with reference to the research questions:

How do the form and underlying goals of horizontal enterprise architecture (EA) collaboration affect use cases for interorganizational business capability maps (BCM)?

The research question consists of three parts, which refer to the form of collaboration, its goals, and the relevant use cases. The first part refers to the collaboration form. We were able to answer this one based on the different characteristics of the observed case studies. The result was the classification of the case studies into the collaboration forms working group and community of practice.

To answer the second part of the research question we conducted semi-structured interviews to identify the goals

of EA collaboration in the respective case studies. It turned out that the working group pursues all the goals that we had already found in the literature. This may be due to the fact that the working group has clear mandates from management that it has to fulfill. Accordingly, they pursue a wide range of different goals. The community of practice, on the other hand, pursues clear collaboration goals. On the one hand, they are interested in a general exchange of knowledge and experience between enterprise architects from different organizations. On the other hand, they are passionate about the creation of industry-wide reference architectures and models. This includes, among others, the BCM.

The last part of the research question refers to the use cases of an interorganizational BCM. Through the interviews, we were able to confirm the majority of the use cases mentioned in the literature. However, we also succeeded in identifying three new use cases. Similar to the collaboration goals, almost all use cases mentioned are relevant for working groups. Only the benchmark use case for visualizing cloud technology is missing. In communities of practice, on the other hand, far fewer use cases are applied. Here, the BCM is used to create a common language. In addition, the BCM serves as a tool for anonymized benchmarks. Since the results of the benchmark are only published among the participants of the community of practice, it also serves to motivate other organizations to participate.

Even if in a working group no other companies have to be motivated to participate, we could imagine the use of the BCM as a benchmarking tool. Since working groups are always under organizational control, it might not be necessary to anonymize the benchmark results. Depending on the goals of the collaboration, mapping information on cloud technologies to business capabilities could be a relevant use case for working groups in our opinion.

VI. Limitation

According to Runeson and Höst [16], case study research is always accompanied by limiting factors such as validity, generalizability, and reliability. To the best of our ability, we have tried to minimize these factors. We have conducted a multiple case study involving and interviewing experts with different roles and from different organizations to avoid threats of validity. We also address generalizability, by considering various collaboration forms and industries with diverse collaboration objectives, BCM use cases, and settings. It should be noted, however, that we have deliberately ignored vertical and hybrid collaboration directions in our study. In order to ensure reliability, the previously defined interview guidelines were iteratively reviewed and revised. However, we would also like to point out that the majority of the interviewees have only been using BCM for collaboration purposes for a few years. Therefore, it would be reasonable to conduct a follow-up study at a later point in time. As interviews with individuals are always subjective, we would also like to emphasize that it would be beneficial to conduct further interviews and case studies to improve the reliability of the results.

VII. Conclusion and Future Work

The increasing research and practical use of interorganizatinoal EAM has motivated us to contribute to this research area with one more case study research. For this purpose, we have defined a research question, which we tried to answer by means of a multiple case study. By conducting semi-structured interviews with participants from different interorganizational EA initiatives, we identified the goals and use cases of the BCM deployed in the respective collaborations. After identifying the collaboration forms based on their characteristics, we were able to relate the collaboration goals and use cases. As a result, we could distinguish between the two collaboration forms working group and community of practice in EA collaborations. Both pursue different goals and use the BCM in different ways. Nevertheless, there are overlaps both in the objectives and in the use cases. In summary, working groups pursue eight different goals, while communities of practice pursue three separate objectives in EA collaboration. While ten different use cases for interorganizational BCM can be considered for the working group, we could observe four intended purposes in communities of practice.

Through our investigations, we were able to confirm the results of previous studies and gain further insights. Thus, the body of knowledge in this area was further deepened and expanded.

The increasing interest from both the scientific and the practical side motivates further research in this field. For example, the use of BCM could also be investigated in vertical EA collaborations. However, since the collaboration here takes place in different parts of the value chain, the collaboration partners very likely also have different business capabilities. This would significantly increase the scope of a joint BCM.

References

[1] T. Mohapeloa *et al.*, "Effects of silo mentality on corporate itc's business model," in *Proceedings of the International Conference on Business Excellence*, vol. 11, no. 1. Sciendo, 2017, pp. 1009–1019.

[2] F. Moore, James, *The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems*. New York: HarperBusiness, 1996.

[3] M. Peltoniemi and E. Vuori, "Business ecosystem as the new approach to complex adaptive business environments," in *Proceedings of eBusiness research forum*, vol. 2, no. 22, 2004, pp. 267–281.

[4] P. Drews and I. Schirmer, "From enterprise architecture to business ecosystem architecture: Stages and challenges for extending architectures beyond organizational boundaries," in *2014 IEEE 18th International Enterprise Distributed Object Computing Conference Workshops and Demonstrations*. IEEE, 2014, pp. 13–22.

[5] B. Diirr and G. Santos, "A systematic literature mapping on interorganizational information systems," in *25th Americas Conference on Information Systems (AMCIS)*, 2019.

[6] R. Breu, S. Dustdar, J. Eder, C. Huemer, G. Kappel, J. Köpke, P. Langer, J. Mangler, J. Mendling, G. Neumann *et al.*, "Towards living inter-organizational processes," in *2013 IEEE 15th Conference on Business Informatics*. IEEE, 2013, pp. 363–366.

[7] T. Mueller, D. Schuldt, B. Sewald, M. Morisse, and J. Petrikina, "Towards inter-organizational enterprise architecture management-applicability of togaf 9.1 for network organizations," in *19th Americas Conference on Information Systems (AMCIS)*, 2013.

[8] A. Vargas, A. Boza, L. Cuenca, and I. Sacala, "Inter-enterprise architecture and internet of the future," in *Doctoral Conference on Computing, Electrical and Industrial Systems*. Springer, 2013, pp. 25–32.

[9] W. Ulrich and M. Rosen, "The business capability map: the" rosetta stone" of business/it alignment," *Cutter Consortium, Enterprise Architecture*, vol. 24, no. 4, 2011.
[10] A. R. Bakhtiyari, A. Barros, and N. Russell, "Enterprise architecture for business network planning: A capability-based approach," in *International Conference on Advanced Information Systems Engineering*. Springer, 2015, pp. 257–269.
[11] F. Yilmaz, O. Schmidt, and F. Matthes, "Interorganizational business capability maps: Use cases for horizontal collaboration," in *27th Americas Conference on Information Systems (AMCIS)*, 2021.
[12] T. M. Simatupang and R. Sridharan, "The collaborative supply chain," *The international journal of logistics management*, vol. 13, no. 1, pp. 15–30, 2002.
[13] F. Yilmaz, D. Akdemir, and F. Matthes, "Why would enterprise architects work together? - a multiple case study," in *26th Americas Conference on Information Systems (AMCIS)*, 2020.
[14] J. Fleischer, M. Herm, and J. Ude, "Business capabilities as configuration elements of value added networks," *Production Engineering*, vol. 1, no. 2, pp. 187–192, 2007.
[15] R. K. Yin, *Case study research and applications: Design and methods*. Los Angeles: Sage publications, 2017.
[16] P. Runeson and M. Höst, "Guidelines for conducting and reporting case study research in software engineering," *Empirical software engineering*, vol. 14, no. 2, pp. 131–164, 2009.
[17] G. Guest, A. Bunce, and L. Johnson, "How many interviews are enough? an experiment with data saturation and variability," *Field methods*, vol. 18, no. 1, pp. 59–82, 2006.
[18] G. Cousin, *Researching learning in higher education: An introduction to contemporary methods and approaches*. Routledge, 2009.
[19] J. Kietzmann, K. Plangger, B. Eaton, K. Heilgenberg, L. Pitt, and P. Berthon, "Mobility at work: A typology of mobile communities of practice and contextual ambidexterity," *The Journal of Strategic Information Systems*, vol. 22, no. 4, pp. 282–297, 2013.
[20] P. Dourish and S. Bly, "Portholes: Supporting awareness in a distributed work group," in *Proceedings of the SIGCHI conference on Human factors in computing systems*, 1992, pp. 541–547.
[21] J. N. Cummings, "Work groups, structural diversity, and knowledge sharing in a global organization," *Management science*, vol. 50, no. 3, pp. 352–364, 2004.
[22] E. Wenger, *Communities of practice: Learning, meaning, and identity*. Cambridge University Press, 1998.
[23] M. M. Wasko and S. Faraj, ""it is what one does": why people participate and help others in electronic communities of practice," *The journal of strategic information systems*, vol. 9, no. 2-3, pp. 155–173, 2000.
[24] M. Barratt, "Understanding the meaning of collaboration in the supply chain," *Supply Chain Management: an international journal*, 2004.
[25] R. Mason, C. Lalwani, and R. Boughton, "Combining vertical and horizontal collaboration for transport optimisation," *Supply Chain Management: An International Journal*, 2007.
[26] E. C. Wenger and W. M. Snyder, "Communities of practice: The organizational frontier," *Harvard business review*, vol. 78, no. 1, pp. 139–146, 2000.
[27] E. Wenger, R. A. McDermott, and W. Snyder, *Cultivating communities of practice: A guide to managing knowledge*. Harvard business press, 2002.
[28] C. Bentley, G. P. Browman, and B. Poole, "Conceptual and practical challenges for implementing the communities of practice model on a national scale-a canadian cancer control initiative," *BMC health services research*, vol. 10, no. 1, pp. 1–8, 2010.
[29] J. Roberts, "Limits to communities of practice," *Journal of management studies*, vol. 43, no. 3, pp. 623–639, 2006.

Deriving a Process for Interorganizational Business Capability Modeling through Case Study Analysis

Fatih Yılmaz[1,2], Julian Feldmeier[1] and Florian Matthes[1]
[1]*Department of Informatics, Technical University of Munich, Boltzmannstr. 3, Garching, Germany*
[2]*Institut für Rundfunktechnik GmbH, Floriansmühlstr. 60, Munich, Germany*

Keywords: Enterprise Architecture, Business Capabilities, Interorganizational, Collaborative, Multiple Case Study.

Abstract: To stay competitive in a globalized, constantly changing market environment with ongoing technological advancements, companies are not only focusing on their organization's key capabilities but also collaborate more closely with partners, suppliers, customers, and also competitors. By analyzing an enterprise's business capabilities, business leaders get an abstracted, holistic view of the organization and the alignment of its business model and visions with the IT. Further, business capabilities and visualizations can help to improve the communication with business partners. Therefore, different companies operating in the same industry collaboratively identify and model common business capabilities to define a shared ontology. Based on the knowledge gained through literature review carried out on the topic of business capability modeling, we conducted a multiple case study in this field. As a result, we derived a reference process for interorganizational business capability modeling which we evaluated by conducting semi-structured interviews with members of different interorganizational initiatives. The outcome of our research is an iterative process of modeling business capabilities in interorganizational collaborations.

1 INTRODUCTION

For decades, companies work together due to many benefits for the collaborating organizations (Diirr and Cappelli, 2018). This becomes especially important as enterprises and their IT landscapes become more and more interconnected (Drews and Schirmer, 2014). To manage the rising complexity of business processes and IT components communicating across the enterprise's boundaries, the concept of interorganizational Enterprise Architecture Management (EAM) has gained interest from the industry and science (Yilmaz et al., 2020).

According to Moore, companies are shifting to collaborate not only with their suppliers and customers but also with their competitors working in the same industry (Moore, 1996). Since these companies often have similar capabilities, it appears natural to collaborate in modeling these capabilities. The design and model of business capabilities supports the alignment of business and IT as it allows an abstracted and holistic view of an organization's abilities and its components (Ulrich and Rosen, 2011). The way a single company can identify, and design its capabilities was subject to an increasing amount of research (Brits et al., 2007). But despite the shift to cooperating business ecosystems and interorganizational collaborations, the process of developing and modeling business capabilities involving multiple companies is barely studied and might vary widely from the one in a single company. With this background, we identified the following research questions (RQ):

RQ 1: How do companies from the same industry proceed in modeling common business capabilities?

RQ 2: How does the interorganizational business capability modeling process differ from the modeling process of a single organization?

To answer the first research question, a literature review according to Webster and Watson was conducted (Webster and Watson, 2002). The relevant literature provided a basis for the analysis of documents and protocols and conducting semi-structured interviews following the guidelines for multiple case study (Runeson and Höst, 2009; Yin, 2017). We evaluated the developed draft process by conducting interviews with experts involved in interorganizational business capability modeling initiatives. The findings are eventually compared to the literature-based approaches of modeling business capabilities in a single company to find differences as well as similarities.

Yılmaz, F., Feldmeier, J. and Matthes, F.
Deriving a Process for Interorganizational Business Capability Modeling through Case Study Analysis.
DOI: 10.5220/0010386306730680
In *Proceedings of the 23rd International Conference on Enterprise Information Systems (ICEIS 2021) - Volume 2*, pages 673-680
ISBN: 978-989-758-509-8

2 RELATED WORK

Before identifying steps of interorganizational business capability modeling, we conducted a literature review to find relevant publications about the modeling steps of business capabilities within a single and multiple organizations (Table 1).

Brits et al. (2007) propose a conceptual framework for modeling business capabilities, where an organization first needs to extract its ”critical information”, including ”Business Entities”, ”Business Rules”, ”Business Processes” and ”Strategic Artifacts”. In this framework, people are not part of resources but a separate component.

España et al. (2015) propose strategies for modeling business capabilities based on the capability-driven design. All strategies consist of three steps: ”Capability Design”, ”Capability Evaluation”, and ”Capability Delivery”, with the research focus lying on the design. Regardless of which starting point for capability design is taken, an iterative structure is proposed involving the business goals, processes, and eventually the context affecting the capabilities (España et al., 2015).

Zdravkovic et al. (2013) conducted research on capability modeling and delivery using cloud services. It is based on a meta-model for capability-driven development (Stirna et al., 2012). The design, which is, next to the delivery, one of the two perspectives in capability-driven development, starts with modeling the enterprise. The Capability-Driven Design and Development (CDD), which is the underlying methodology in the research of España (2015), Zdravkovic (2013), and Stirna (2012), involves enterprise models, goals, processes, the underlying resources, as well as concepts. It also considers the application context in delivering the capabilities to allow a fast reaction to changes (Zdravkovic et al., 2013; Stirna et al., 2012).

Bondel et al. (2018) report from the modeling of a business capability map (BCM) based on a case study. The desired goal was the improvement of business/IT alignment through the application of the BCM (Bondel et al., 2018). A guideline for BCM creation by The Open Group was used as a basis for their approach (TheOpenGroup, 2018). The case study started with the identification and modeling of more general, top-level capabilities first.

Overall, these papers granted us profound knowledge about the modeling steps of business capabilities in a single organization, including the role of the involved components. We further conducted a literate review on interorganizational business capability modeling initiatives, methods and strategies. Due to the novelty of the topic, we were not surprised to only find a handful of papers that mention business capabilities in an interorganizational context.

Table 1: Steps of BCM Modeling in Single Organization.

Step	Authors
Use draft capability model	Brits et al. (2007), Zdravkovic et al.(2013), Bondel et al. (2018)
Analyze business processes & functions	Brits et al. (2007), España et al.(2015), Zdravkovic et al. (2013)
Analyze visions & goals	Brits et al. (2007), España et al.(2015), Zdravkovic et al. (2013)
Include resources	Brits et al. (2007), Zdravkovic et al. (2013), Bondel et al. (2018)
Include responsibilities & roles	Brits et al. (2007), Bondel et al. (2018)
Relations between business capabilities	Brits et al. (2007), España et al.(2015), Zdravkovic et al. (2013), Bondel et al. (2018)
Define KPIs	España et al.(2015), Zdravkovic et al. (2013)
Analyze application context	España et al.(2015), Zdravkovic et al. (2013)
Create BCM	Bondel et al. (2018)
Evaluation and refinement	Brits et al. (2007), Bondel et al. (2018)

Bakhtiyari et al. (2015) introduce a capability-based approach for enterprise architecture in business network planning (Bakhtiyari et al., 2015). By using a BCM, the individual partners align their capabilities with the capabilities of a global capability map. This is used to map global capabilities to requirements and relations. However, a description for the creation of the global BCM itself is not presented.

Fleischer et al. (2007) use business capabilities to configure and evaluate value-added networks. This allows improved coordination of the single nodes inside the network (Fleischer et al., 2007). The result of their research is a process for configuring the value-added networks. A BCM is developed and used to map business capabilities to the nodes of the network and to compare the individual nodes' BCMs. This research does describe the identification and modeling of business capabilities in an interorganizational context, but the identified business capabilities are derived from the added value of a single company and include the outsourced capabilities of its partners and suppliers to configure the nodes in the network. In contrast, our research is focusing on the collaborative identification and modeling of common business capabilities by companies working in the same industry.

Overall, we did not find literature proposing a general process of defining business capabilities in interorganizational collaboration. Despite this result, the industry projects that are currently in progress underline the actual relevance of this topic.

3 CASE STUDY

The main objective of our research is the identification of general steps in the process of modeling business capabilities in interorganizational collaborations with companies from the same industry. In order to build profound knowledge in the area of business capability modeling, we first conducted the literature review as described in the previous section.

As our research uses different case studies as a basis for collecting information, we now want to present the case studies. In the first case study, the cooperating enterprises are public service media companies from one European country cooperating in a working group. The second case study consists of public service media companies from several European countries within a community of practice (Wenger et al., 2002). The documents and protocols provided by these case studies were analyzed to derive a draft process of collaborative business capability modeling.

To enrich and evaluate the findings, we conducted semi-structured interviews with case study partner 1, 3, and 4. Case study 3 is an interorganizational collaboration active in the gambling domain. The interviewee is a research assistant, who was responsible for planning, consulting, and implementing the project. The fourth case study was carried out with an association of organizations operating in the finance industry. The interviewees were enterprise architects and project leaders of involved companies. Their motivation for collaboration was to provide industry-specific enterprise architecture artifacts, which are not only limited to a BCM. A summary of involved organizations can be seen in Table 2, whereas our case study design is illustrated in Figure 1.

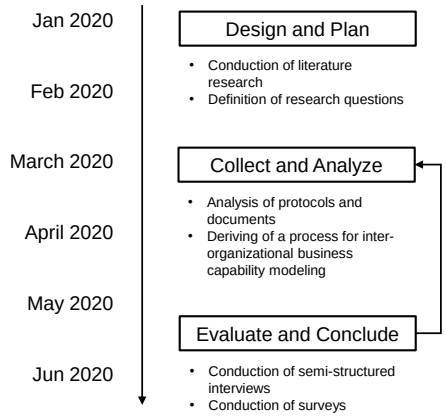

Figure 1: Study Design acc. Runeson and Höst (2009).

4 RESULTS

4.1 Reasons and Expectations

Before deriving the process of modeling business capabilities in an interorganizational collaboration, the individual reasons of the case studies' members for participating in the collaborative modeling activity need to be analyzed (Yilmaz et al., 2020). This provides a holistic view of the projects and allows to identify possible influencing factors.

The reason for the first case study is to provide a basis for mapping their application portfolio to the capabilities. This is then used to visualize which applications are used by the organizations in which group of capabilities, which organizations are similar or different in certain business capabilities with regard to their application landscape, as well as revealing the potential for standards and consolidation. The second case study's aim is to establish an industry-specific reference model of a BCM and exchange knowledge and experience. In the third case study, the involved companies want to identify and visualize similar and overlapping capabilities to reveal the potential for synergies, merging, and acquisitions, and create a common understanding and taxonomy. The fourth case study justified the collaborative modeling of capabilities with the creation of a reference model to be used by organizations operating in the same industry.

4.2 Structure of the Meetings

The first case study's modeling team consisted of the heads of departments in IT and EA, project leaders of IT- and EA projects, and enterprise architects. By involving project leaders and heads of departments, the companies ensure that employees with fundamental knowledge about their own company's business architecture can represent the enterprise appropriately as well as guarantee high quality of the result. Additionally, each member had to name a stand-in, who was continuously kept up-to-date. Still, internal presentations and discussions with business leaders and executives as stakeholders of the project were performed in order to collect feedback and impressions from a business point of view. This was observed in the second

Table 2: Case Study Partners.

	Case Study Partner 1	**Case Study Partner 2**	**Case Study Partner 3**	**Case Study Partner 4**
Industry	Broadcasting	Broadcasting	Gambling	Banking and Finance
Source of Information	Documents, protocols and semi-structured interview	Documents and protocols	Semi-structured interview	Semi-structured interview
Collaboration Form	Working group	Community of practice	Working group	Community of practice
Collaboration Goal	Basis for further collaboration	Reference architecture	Identify synergies and create taxonomy	Reference architecture
No. companies involved	13	4	10	>30
Meeting Structure	Physical	Virtual and physical	Physical	Virtual

and fourth case study as well, where the relevance of getting a cross-section of stakeholders, especially but not only from the business side, was pointed out. The meetings in the first case study were physical as all member organizations operated in the same country and should take place every quarter with extra meetings arranged when needed. In between the meetings, feedback was collected inside each company by the corresponding team members and presented in the next meeting.

The second case study's modeling team consisted of enterprise architects working in each of the participating organizations. The meetings were scheduled every two weeks and were mostly virtual due to the international scope of the project. Additionally, the team conducted a physical workshop in the last third of the project. In the meetings, the members provided feedback regarding the current work results, gained from internal discussions in their organization, which was then revised by the members responsible for this deliverable.

With the third case study project being solely driven by strategic goals, namely the revealing of potential for synergy and acquisitions, the people involved in capability modeling were mostly business leaders and heads of departments. This also illustrates the relevance of business capabilities for the business perspective. It stands out that in the third case study the interviewee, a research assistant acting as an enterprise architect, was coordinating and leading the project because most of the participants were new to the field of business capabilities or enterprise architecture itself. Here, the participants delivered ideas, information, and held discussions which were collected by the enterprise architect, accumulated and evaluated through several interviews and presentations.

The modeling team of the fourth case study consisted of enterprise architects and project managers.

In the first case study we could observe an assignment of responsibilities and tasks to subgroups. The allocation of roles and responsibilities was performed by the members of the second case study as well. Here, certain members were responsible for collecting and implementing the feedback provided by the individual members and their stakeholders. Noteworthy is the allocation of a coordinating role in case study 1, 2, and 3. Appointing a moderator to coordinate the meetings as well as to collect and distribute feedback and tasks is supporting a clear structure of the meetings and serves as a contact person. The forming of subgroups as in case studies 1 and 2 to collaborate on specific topics was not confirmed by case studies 3 and 4. Analyzing the first two case studies, we could identify a disagreement in the form and relevance of the venue. This was confirmed by case studies 3 and 4, as the meetings of case study 3 were physical interviews and workshops, whereas the members of the fourth group only had virtual meetings.

4.3 Collaborative Modeling of Business Capabilities

Each case study used a **draft business capability model** or business capability framework to get a better understanding of the desired outcome, to use it as a guideline, or as a foundation for their own modeling. The draft capability model can be provided by one of the members or obtained from external sources. In the second case study enterprise architects decided to use an external BCM to identify the appropriate level of abstraction and used it as a basis for the development of the own capability map. In addition to that, case study 2 and also case studies 3 and 4 used existing BCMs from some of the members, whereas in case study 1, a capability map from a company oper-

ating in the same industry, yet not participating in the project was used as a draft. As in case study 4, the BCMs which were brought in by members worked as a foundation first, but due to overlapping, duplication, and the lack of following any particular standard, it was decided to start from scratch, without using any draft in order not to be biased. Using existing BCMs from members or external sources provides a basic understanding for the stakeholders and also for the development team. In addition to that, it can be used as the starting point for identifying business capabilities and creating the BCM as it was done in case studies 2 and 4.

All projects started with the modeling of **general business capabilities** before adding granularity by modeling lower-level capabilities. This might be caused by the usage of draft models and frameworks that usually present a general, industry-independent high-level architecture of an enterprise. It also makes sense in the context of collaboration, as in a conglomerate of enterprises it may be easier to find common top-level capabilities, which can then be used as the basis for further decomposition if needed, than finding consensus for specific low-level capabilities. Additionally, as case studies 2 and 4 had the aim of building an industry-specific reference architecture, the needed degree of granularity was not as high as one might expect in a single company where the BCM is used for further, profound analysis. This was confirmed by the interviewees. The fear of revealing valuable insights and therefore potentially losing an advantage over the other members, which are still operating in the same industry, by modeling more specific, lower-level capabilities was not found to be a reason for starting with top-level capabilities. Business capabilities themselves abstract from the underlying technologies and processes and hence would not reveal many details. According to the interviewees, in case of different views on the desired modeling level of capabilities by the member organizations, discussions were held until a general agreement was achieved. In case study 3, the modeling group was working with a BCM from one of the members as a foundation. This map was extended in the interorganizational BCM creation by coloring the newly added capabilities. This helped to reach a consensus regarding the new capability map. Potential member-exclusive capabilities were not found to be problematic while modeling the capabilities and the creation of the BCM. The case studies introduced up to six categories to group the business capabilities. However, it was stated that grouping was not of great significance but only improves orientation in the BCM. Case studies 2 and 4 explicitly allow the enterprise-specific re-grouping of their grouping proposal. Examples for categories occurring in the capability maps are ”Core”, ”Strategic”, and ”Support” capabilities, which is also proposed by TOGAF (TheOpenGroup, 2018).

Modeling of business capabilities within a single enterprise can be based on the company's **business processes** (España et al., 2015; Brits et al., 2007; Zdravkovic et al., 2013). In case study 1, the underlying business processes of the different organizations were analyzed through the business process chains and used for identifying the business capabilities but were not modeled with them. During the evaluation through interviews, it was pointed out that the business processes and the internal structure of the organizations were too different to be embedded in the capabilities. Case studies 2, 3, and 4 did not involve the business processes. Case study 3 analyzed the business functions in order to identify the business capabilities. Additionally, organization charts were analyzed. Even though business processes can be helpful to identify or evaluate business capabilities, strict adherence to business processes in modeling the capabilities led to problems in the further progress of the project, as the developed BCM closely resembled a process map and caused the need for renewed discussion and revision.

The company's **vision and goals** can play a major role in defining the business capabilities within a single company (España et al., 2015; Brits et al., 2007; Zdravkovic et al., 2013). However, in all of the case studies, the companies' vision and goals were not analyzed in the modeling process. The obtained BCMs were throughout visualizing the current business capabilities and did not include a to-be view. Therefore, a company's goals and visions could be affecting the final usage of the obtained BCM but did not affect the creation of it in an interorganizational approach.

In literature, **responsibilities and roles** are components of business capabilities (Brits et al., 2007; Bondel et al., 2018). In most of the case studies, roles and tasks were no components of the modeled capabilities. This seems natural in a conglomerate of various organizations, where different skills and tasks enable the capabilities, depending on each company. Only in case study 3, people responsible for the capability were included in the capability description. This was caused by the fact that the initiative used the BCM from one member not only as templates for orientation but extended them with the capabilities from other members. The other case studies did not include responsibilities.

The creation of a **common vocabulary** seems to be crucial as we observed a shared glossary in case

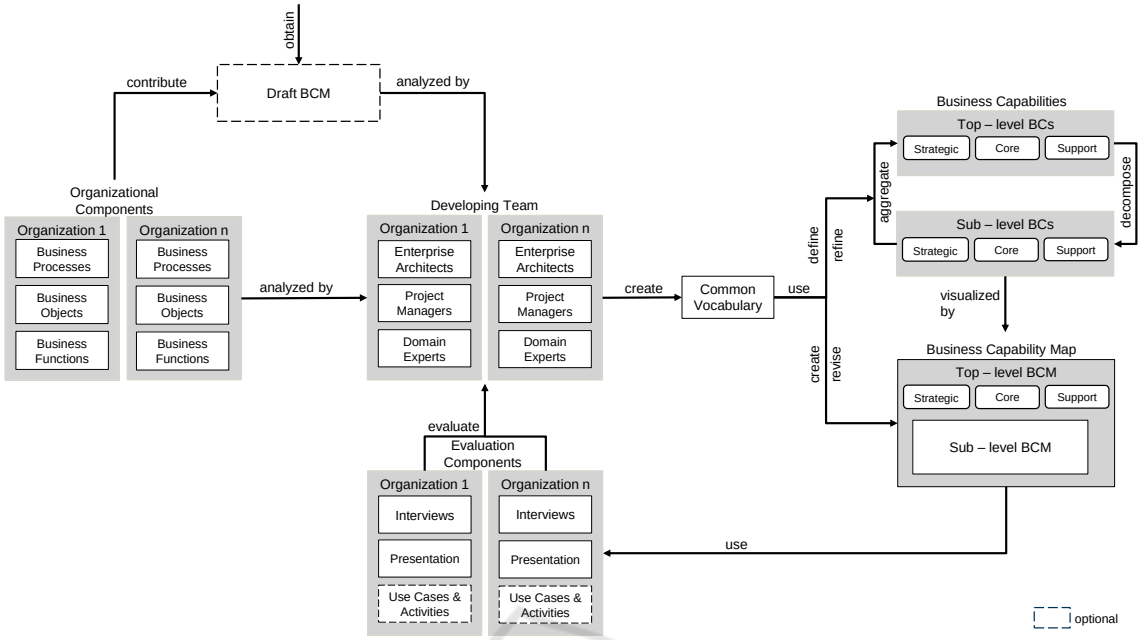

Figure 2: The derived reference process of interorganizational business capability modeling.

studies 2 and 4. Since these two groups contain organizations from different countries, they determined that the common language is English. In case study 4, the interviewees explicitly mentioned their focus on differentiating business capability names and names of the service domains. This is meant to prevent confusion within the member group. Case study 1 developed and introduced a glossary and naming convention to provide a common language and vocabulary in the first meetings. At the same time the finalized business capabilities were documented including a description, the outcome of the capability, and a reference to the position on the BCM. The descriptions introduced and followed this common vocabulary.

In general, the business capabilities modeled in the case studies did not embed **resources, applications or technologies**. Even if the organization's technologies play a negligible role, as the before mentioned internal structure and processes result in a variety of used technology. Only in the first case study, applications and technologies used by each member were collected, analyzed, and put in relation to the capabilities, which was caused by the additional collaboration target of building an application portfolio that should be mapped to the BCM. Nevertheless, the technologies were not modeled in the final description of the capabilities or in the BCM. In case study 4, it was pointed out that the technologies, roles, and business processes should not be modeled in the interorganizational BCM.

The identified business capabilities, their descriptions, sub-capabilities, and interrelations were **constantly evaluated**. This was done by presenting the BCM to the stakeholders of each company to collect feedback. But also use cases and activities were collected from organizations and used to validate the capabilities. In general, there was a high level of support and involvement of the business leaders and stakeholders from each contributing organization. The evaluation resulted in changes of capability names, the further decomposition of a former top-level capability, or the aggregation of sub-level capabilities until consensus was reached. In case study 2, the group focused mainly on modeling one core capability at a time until all members agreed on the naming, description, and the sub-capabilities. As the point of view got extended and shifted, the name, description or the composition of sub-capabilities to core capabilities had to be revised and adjusted. This iterative process validated the final capabilities and guaranteed the fulfillment of each organizations' expectations.

Based on our observation in the case studies, we designed a reference model visualizing the steps and components of an interorganizational business capability modeling initiative (Figure 2). By following the guideline, organizations operating in the same industry can collaboratively develop a common BCM.

We suggest to begin with the developing team consisting of enterprise architects, domain experts, and department heads. The developing team can assign responsibilities, e.g., a moderator for the meetings or someone to incorporate the feedback. The

structure of meetings, and their regularity has to be set. The development and use of a common language and vocabulary are crucial and highly recommended. With a common glossary developed, the modeling team analyses the organizations' charts, business processes, business objects, and business functions to identify common top-level capabilities. Identified business capabilities do not embed the underlying business processes, people, and roles as it might not be useful or even possible with multiple organizations involved. Further, the mapping of the underlying technology and application is optional. The identification and modeling can be supported by the usage of a draft business capability model. A draft BCM can also introduce stakeholders or members of the modeling team, who may be unfamiliar with the concept of business capabilities and illustrate the desired outcome. Our approach recommends the top-down approach, due to the background of the interorganizational context. The identified top-level capabilities should be extended with a description using the common vocabulary and be illustrated in a BCM to visualize relations between the capabilities. The top-level capabilities can be grouped to facilitate the identification of relations between the capabilities and their role in the organizations. We suggest the grouping into three categories as proposed by The Open Group (2018) and Ulrich et al. (2011): Core capabilities, support capabilities, and strategic capabilities.

This first version of the BCM is presented in the individual organizations to stakeholders and domain experts to collect feedback and to evaluate the first version. With the feedback incorporated, the BCM can be adjusted. This is an iterative process involving constant feedback and evaluation from the stakeholders and revision by the developing team. If a bottom-up approach is chosen, the specific lower-level capabilities should be grouped and their relations illustrated, before evaluating them using the stakeholders' feedback. With many organizations involved, this can bear a challenge and is only recommended if necessary for the collaboration goal. Aggregating the low-level business capabilities to higher-level capabilities involves the agreement of the modeling team as well as consensus with the stakeholders. In general, aggregation of capabilities can result in changes of relations or the composition in other layers, therefore a holistic view, achieved through the BCM, is crucial. The BCM should allow adjustments during the modeling, e.g., decomposing former top-level capabilities and vice versa. The degree of granularity for each business capability depends on its intended purpose. If the aim is the identification of synergies and potentials for consolidations a high granularity is useful. If defining a holistic reference architecture the granularity can be lower. Members of the developing team can submit change requests for the BCM if necessary in the later stage.

5 DISCUSSION

In this paper, we introduced a reference process of interorganizational business capability modeling derived from multiple case studies, in order to answer our research questions defined in section 1.

We could observe different approaches of collaborative BCM development. First, we identified the relevance of draft BCMs either submitted by members or obtained from external sources. A common glossary is an integral part of the process and is created at the beginning of as well as applied and refined during the modeling process. The developing team consists of enterprise architects as well as domain experts and department heads. By analyzing the companies' organization charts, functions, processes, and objects the developing team can further identify and describe capabilities. The derived process is of iterative nature, where each participant collects feedback from its company and stakeholders, which is merged and used to revise the capabilities. Responsibilities should be allocated inside the developing team to provide structure and a clear contact persons. After coming to an agreement of a final BCM, the result is being evaluated by the members regularly in order to find any deviations or needs for changes in the BCM. Due to the stability in the nature of a BCM, major changes in the BCM were not expected and observed.

The modeling of business capabilities in collaboration was found to be less driven by the companies' vision and goals as in the single enterprise. Even though the involved companies' technologies are analyzed, they play a minor role and are not modeled within the capabilities. Roles should not be taken into account in collaborative projects. BCMs obtained through interorganizational collaboration are found to be less granular than in a single organization. The introduction of a common vocabulary is not necessarily needed in a single organization whereas it is an important component in the interorganizational approach. The top management and stakeholders are usually supporting interorganizational collaboration and provide valuable feedback, whereas this is not generally the case in a single organization with, e.g., capability modeling initiatives driven by the IT department. Further, we could not confirm the application of KPIs. The reason for this can be the early stage of BCM usage in most of the observed cases.

6 LIMITATION

As our findings are based on case studies, which generally have limitations such as validity, generalizability, and reliability (Runeson and Höst, 2009). We used several methods to cope with these limitations. To ensure construct validity the interviews were conducted with employees from different organizations with the necessary background. By conducting multiple case studies from various industries with different collaboration motivations and goals, the derived process can be applied to most interorganizational collaboration projects. Therefore, the generalizability aspect is addressed. The reliability aspect is ensured by traceable analysis and results. To fulfill this criterion, the interviews were following a previously defined guideline reviewed by a second researcher.

7 CONCLUSION

In this paper, we presented related work in the field of business capabilities in a single- and interorganizational context. As a foundation, we conducted a literature review to obtain profound knowledge about business capabilities and their modeling in single organizations as well as available frameworks. Through the analysis of four case studies, we identified the steps of interorganizational business capability modeling. By conducting interviews, we could iteratively evaluate and revise the derived steps. This resulted in the process of interorganizational business capability modeling for companies operating in the same industry as illustrated in Figure 2.

Based on our research, future studies could be conducted on the composition and size of the teams in up-scaled projects. More organizations and stakeholders involved in the modeling process can increase the complexity and communication effort in the developing team.

REFERENCES

Bakhtiyari, A. R., Barros, A., and Russell, N. (2015). Enterprise architecture for business network planning: A capability-based approach. In *International Conference on Advanced Information Systems Engineering*, pages 257–269. Springer.

Bondel, G., Faber, A., and Matthes, F. (2018). Reporting from the implementation of a business capability map as business-it alignment tool. In *2018 IEEE 22nd International Enterprise Distributed Object Computing Workshop (EDOCW)*, pages 125–134. IEEE.

Brits, J., Botha, G., and Herselman, M. (2007). Conceptual framework for modeling business capabilities. In *Proceedings of the Informing Science and IT Education Joint Conference*, pages 151–170.

Diirr, B. and Cappelli, C. (2018). A systematic literature review to understand cross-organizational relationship management and collaboration. In *Proceedings of the 51st Hawaii International Conference on System Sciences*.

Drews, P. and Schirmer, I. (2014). From enterprise architecture to business ecosystem architecture: Stages and challenges for extending architectures beyond organizational boundaries. In *2014 IEEE 18th International Enterprise Distributed Object Computing Conference Workshops and Demonstrations*, pages 13–22. IEEE.

España, S., Grabis, J., Henkel, M., Koç, H., Sandkuhl, K., Stirna, J., and Zdravkovic, J. (2015). Strategies for capability modelling: analysis based on initial experiences. In *International Conference on Advanced Information Systems Engineering*, pages 40–52. Springer.

Fleischer, J., Herm, M., and Ude, J. (2007). Business capabilities as configuration elements of value added networks. *Production Engineering*, 1(2):187–192.

Moore, J. . (1996). *The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems.* HarperBusiness.

Runeson, P. and Höst, M. (2009). Guidelines for conducting and reporting case study research in software engineering. *Empirical software engineering*, 14(2):131.

Stirna, J., Grabis, J., Henkel, M., and Zdravkovic, J. (2012). Capability driven development–an approach to support evolving organizations. In *IFIP Working Conference on The Practice of Enterprise Modeling*, pages 117–131. Springer.

TheOpenGroup (2018). *The TOGAF Standard, Version 9.2*.

Ulrich, W. and Rosen, M. (2011). The business capability map: the" rosetta stone" of business. *IT Alignment Enterprise Architecture*, 14.

Webster, J. and Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS quarterly*, pages xiii–xxiii.

Wenger, E., McDermott, R. A., and Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Harvard Business Press.

Yilmaz, F., Akdemir, D., and Matthes, F. (2020). Why would enterprise architects work together?-a multiple case study. In *Americas Conference on Information Systems (AMCIS), Virtual*.

Yin, R. K. (2017). *Case study research and applications: Design and methods*. Sage publications.

Zdravkovic, J., Stirna, J., Henkel, M., and Grabis, J. (2013). Modeling business capabilities and context dependent delivery by cloud services. In *International Conference on Advanced Information Systems Engineering*, pages 369–383. Springer.

APPENDIX B

Additional Publication in Original Format

Investigating the Challenges of European Public Service Media Companies from an Enterprise Architecture Point of View

Fatih Yılmaz*†, Florian Matthes*
*Chair for Informatics 19 (sebis)
Technical University of Munich
Garching b. Munich, Germany
{fatih.yilmaz,matthes}@tum.de
†Institut für Rundfunktechnik GmbH
Munich, Germany
fatih.yilmaz@irt.de

***Abstract*—By introducing disruptive technologies, people started to consume media in new ways. Consequently, the media industry is concerned with adapting these new trends and develop new products, which fit the customer needs. In this paper, we investigate the challenges the public service media companies are facing in competing with the market and how those challenges can be addressed by Enterprise Architecture (EA). Based on a literature review on related work, we conduct a multiple case study with four European public service media companies from four different countries. In semi-structured interviews with eight people in three different roles, we could identify six challenges. Three of the six challenges could be confirmed by related literature. Many European public service media companies' chances for success are currently at risk by rigid organizational structures, resource scarcity, and silo mentality. Furthermore, in the mid or long term the historically grown, unstructured and hardware-focused IT architecture can cause problems with regard to agility in meeting new business requirements. Cross-medial production and reorientation on audience needs, are seen as further challenges in the long run. Finally, we discuss how and by which EA layers these challenges can be addressed.**

***Index Terms*—Enterprise Architecture, Public Service Media, Challenges, Multiple-Case Study**

I. Introduction

In the last few years, the media industry goes through a fundamental market disruption [1]. New competitors and technologies force the media companies to adapt their existing business models in order to remain competitive. In fact, these changes affect their business strategy in the first place, but also the business-enabling information technology (IT). Thus, the alignment of business and IT has become increasingly inevitable in current business practices, as IT has done a major shift towards being a central part within modern organizations [2]. Success stories like that of Netflix, a new major player in the media industry, are front and center. They show, that even in the media sector IT is no longer considered as a business supporting capability but plays a central role in their digital transformation process [3].

In establishing such a value-creating IT strategy, the business needs should be taken into account. Thereby, inconsistencies in the business IT alignment which can cause increased monetary and time costs in the long term can be reduced or even avoided. For that reason, the basis for an integrated approach between business and IT is that organizations have a clear understanding of their internal processes and relationships, as well as of their interactions with others, including customers, suppliers or governmental regulators [4].

In order to get an awareness of all these different stakeholders and value streams, an organization needs to have a holistic view of itself. To address this need, there has been a rising interest in Enterprise Architecture (EA) and Enterprise Architecture Management (EAM) in recent years. EA provides exactly this holistic view of the enterprise with its internal and external relationships [4].

However, before identifying appropriate EAM layers, we have to understand the unique business model of the public service media industry. Therefore, we conducted interviews to identify the current and future challenges which public service media companies are facing with regard to digitalization. Based on that, the relevant EA layers can be identified, to address these challenges.

We examine the following research questions (RQ):

RQ1: Which challenges hinder public service media companies in the process of digital transformation?

RQ2: Which EA layers support the public service media companies in overcoming those challenges?

To answer these questions, we conducted semi-structured interviews with eight interview partners. In order to ensure diversity and allow data triangulation, we selected the interviewees from three different roles and four different European public service media companies. The study was conducted by following the guidelines for multiple-case study of Runeson and Höst [5] and Yin [6].

- accepted version -

The paper is structured as follows. In the next section, we present the related works to our paper. After that, we describe the case study design with the underlying overall research approach. In the next section, the identified challenges are presented by dividing them in the current and future ones. Subsequently, appropriate EA layers for each challenge are discussed. After showing the limitations, the paper is concluded with a summary of the results and remarks on future work.

II. Related Work and Background

Based on the defined research questions, our literature review focuses on challenges faced by public service media companies with regard to digital transformation.

The media industry exists for decades. In the 1940s it was dominated by the radio technology [7]. With the introduction of the first television, the popularity of radio stagnated. Eventually, television broadcasting reached mainstream [8]. Although the internet was perceived as a revolutionary technology in the 1990s, it was predicted as a short-lived supportive tool [9] and a temporary distribution method [10]. However, these hypotheses were refuted [11]. Today, the internet plays a major role in the media industry. It fundamentally changed the way of content creation, distribution and consumption [12], [13].

Nevertheless, or even because of the online technology the public service media enterprises are facing challenges in transforming their existing business model. Thus, they have to assign market shares to new competitors such as Netflix and Amazon. This statement is supported by the reach of subscription video on demand (SVOD) services. In Europe, the average penetration of SVOD providers in TV households is 14% and rising [14].

Challenges of the public sector is a well-investigated topic in scientific literature. Many researchers have identified critical obstacles, which are reoccurring in different public enterprises [15]–[20]. However, most of these challenges are socio-politically orientated. Only a few researchers have investigated the challenges from a digitalization point of view [20]. Nevertheless, some socio-political challenges can also hinder companies in the process of digital transformation. In particular, the following three challenges are mentioned in related work:

- **Silo mentality:** Although the communication between public media companies improved in the last years, e.g. by institutions like the European Broadcasting Union (EBU), the internationalization and globalization is still a challenge for some companies [18].
- **Crossmediality:** For traditional public service broadcasting companies, the integration of the online distribution channel to the existing ones (radio and TV) is a challenging project [15], [16].
- **Reorientation on audience needs:** The number of people watching television is decreasing over the last years. Especially, the younger audience of public service broadcasters is shrinking [17].Therefore, media companies are forced to adapt their business model and extend their services.

One goal of EA is to transfer the historically formed legacy processes into an integrated environment. This provides a strategic context for the adaption of information technology in response to the constantly changing needs of the business environment [21]. For that reason, EA defines a holistic view of the enterprise IT architecture instead of screening each and every IT components [22]. Although the documentation of the architecture in layers has proven to be useful, there are different layer models in the literature. Many researchers divide EA in three to four layers [4], [23], [24]. A similar structure of EA can also be found in commonly accepted EA Frameworks such as TOGAF or Zachman [21], [25]. To ensure unambiguity this paper refers to the approach presented by Buckl (2011) which consists of the three layers: Organization & Processes, Application & Information, and Infrastructure & Data. It also includes the cross-cutting elements Visions & Goals, Strategies & Projects, and Principles & Standards, which affect the previously mentioned layers (see figure 2).

Once the critical EA layers are identified, it still is a challenging project to establish EAM competences in public sector companies. Compared to the private sector more obstacles have to be overcome, such as organizational and communicational challenges [26], [27]. However, the implementation and operation of EAM is not part of this study.

III. Case Study Design

According to Yin (2017), a case study is an inquiry that investigates a contemporary phenomenon within its real-life context [6]. Since we want to investigate the challenges of public service media companies in regard to digitalization, a case study is a suitable research methodology. In our research, we follow the guidelines for conducting and reporting case study research in software engineering by Runeson and Höst (2008) [5]. Further, since we focused on ”in-depth accounts of experienced and perceptions with individuals”, we conducted semi-structured interviews [28]. The temporal course and the case study phases are visualized in Figure 1.

- **Design and Plan:** The main objective of this case study is the identification of challenges of public media service companies. Based on these insights, we further discuss EA as a discipline to address the challenges. Derived from this, we defined two research questions we mentioned in the Introduction section. In order to increase the reliability of results, we conducted a multiple-case study with four companies from four different European countries.
- **Prepare and Collect:** In total, we interviewed eight experts from the IT domain in different roles (Head of IT, Enterprise Architect and Solution Architect). Seven of eight interviews were conducted onsite. Due to geographical distance, one interview was conducted via phone call. Information on interviewed companies is summarized in Table I.

TABLE I
OVERVIEW AND SPECIFICS OF CASE ORGANIZATIONS AND CONDUCTED INTERVIEWS

	Company 1	**Company 2**	**Company 3**	**Company 4**
Type of broadcasting	Regional channel	National channel	National channel	National channel
Structure	Public Service Media	Public Service Media	Public Service Media	Public Service Media
Company size (No. of employees)	5,000 - 10,000	<5,000	>10,000	<5,000
Is EAM introduced?	Introducing	Canceled	Canceled	Canceled
No. of interviews	2	2	1	3
Position of interviews	Head of IT, Enterprise Architect	Head of IT, Solution Architect	Enterprise Architect	Solution Architects

- **Analyze and Conclude:** By clustering the data from the interviews, we could consolidate to six challenges. Only challenges mentioned by at least half of the participants were considered in the results. Subsequently, relevant literature was used to validate our findings from the interviews.

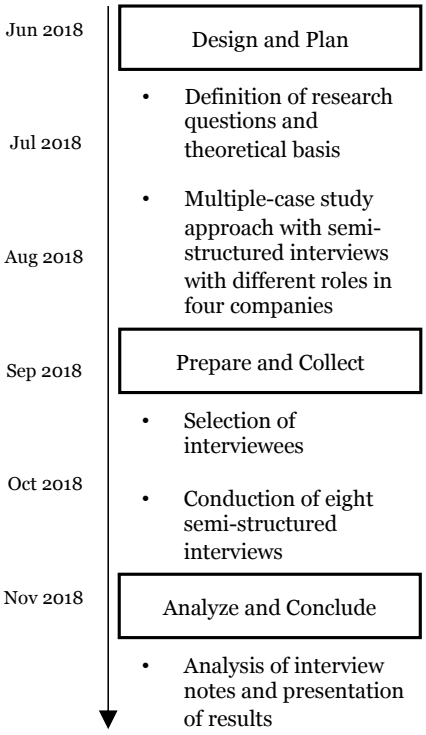

Fig. 1. Case Study Design (according to [5])

IV. CHALLENGES IN PUBLIC SERVICE MEDIA

In the following subsections, we will present the results of the conducted interviews. Based on the number of interviewees mentioned each challenge, we defined its relevance (see Table II). In order to ensure a minimum level of relevance, we only considered challenges which are mentioned at least by 50% of the experts.

A. Current Challenges

During the interviews, we distinguished between current and future challenges. The current ones are defined as challenges which are observed and seized already by the experts. In the following, the current challenges of public service media companies are listed:

- **Rigid organizational structures (C1):** More than half of the participants told us that rigid organizational structures are one of the current challenges hindering them in increasing their degree of digitalization. One interviewee told us, that he often observes steep hierarchies and bureaucratic hurdles in his daily work. Consequently, mostly federal structure of public service media companies dampens the willingness to change.
- **Resource scarcity (C2):** 75% of the interviewed experts stated that they face resource scarcity at work. Low resources and current cost-saving measures have even led to the failure of already started EAM initiatives in three of four public service media companies. The fourth company cannot form an EAM unit due to lack of resources but would be interested in having one.
- **Silo mentality (C3):** Low communication and isolated work environment between media companies and even internal divisions is perceived by only half of the interviewees as a challenge. We concluded that historical silos in the media production and distribution process reduce the readiness for internal and external cooperation. Therefore, surveyed companies have low or even no insight into ongoing projects in other companies. As a consequence, common product understanding and knowledge base are suffering. For instance, during the interviews, we realized that many interviewees had a different understanding of the ”product” term. Some see only distribution ready content as a product. Other employees use the term product also for raw materials.

B. Future Challenges

In the following, we will present the future challenges which public service media companies will probably face. These are defined as obstacles which are not endangering the business today. But if not taken countermeasures against them this can change in the future.

- **Unstructured and hardware-focused IT architecture (C4):** Almost every interviewee (7 of 8) fears, that the current IT architecture will eventually cause issues in transforming to a digital business. Only one of four investigated companies have documented their application

landscape. This makes it visibly difficult to identify the consolidation potential of IT. Further, industry-typical hardware-heavy and silo-like architecture reduce flexibility and ability to adapt to new business requirements and technologies. This means also, that disruptive technologies to come are difficult to introduce in the existing IT landscape of the company.

- **Crossmediality (C5):** With 87,50% also a very prominent challenge among the participants is crossmediality. By extending the distribution of content by the internet, media companies realized that they need a more content oriented and cross-branch communication. Consequently, the organizational and often spatially divided channels (TV, radio and online) have to be amalgamated. However, this will be a challenge on a technical, organizational, and personal level.
- **Product development and extension (C6):** Recent studies show that the current business model of broadcasting is only partly future-oriented. So it comes that the average age of people watching public service TV is at 60 years in Germany. Another report shows that the watching time with young audience (14-29 years) simultaneous decreases (-9% form 2017 to 2018) during the last years [29], [30]. This leads to several projects on reorientation on customer needs with reengineering and extension initiatives on content and product line. This indeed can be an opportunity to increase efficiency by introducing new technologies. But on the other hand it can lead to a heterogeneous and complex IT landscape, if not managed properly. With 75%, the majority of our interview partners could confirm this trend.

TABLE II
RELEVANCE OF CHALLENGES

	Mentioned by interviewees (In percentage terms)
Unstructured and hardware-focused IT architecture (C4)	87,50%
Crossmediality (C5)	87,50%
Resource scarcity (C2)	75%
Product development and extension (C6)	75%
Rigid organizational structures (C1)	62,50%
Silo mentality (C3)	50%

V. ADDRESSING BY EA LAYERS

Since EA evolved to a popular research topic during the last couple of years, there is a variety of definitions for it [4], [31]–[34]. But put simply, EA outlines a blueprint of the company's business architecture and its information systems [34]. This blueprint can address the mentioned challenges by providing transparency among the business and IT processes. However, it is very difficult to get an overview of the structure and processes of a real-world company. The EA Building Blocks presented by Buckl (2011) can be used as a tool to transform and visualize the complex structures of a real company to a manageable abstracted EA model.

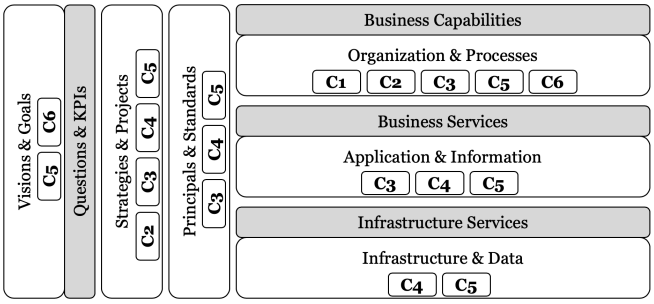

Fig. 2. Overview of EA Building Blocks and addressed challenges (according to [24])

This model consists of the Organization & Process layer, the Application & Information layer and the Infrastructure & Data layer (Figure 2). The first layer describes the organization related aspects of the enterprise. The second one focuses on the business applications and their interfaces to each other. The Infrastructure & Data layer provides the foundation for the previous layers. It contains the technical infrastructure components, such as hardware devices. Additional abstractions like Business Capabilities, Business Services, Infrastructure Services and Questions & KPIs encapsulate the architecture layers. Business Capabilities describe the activities of the enterprise which play a part in its value creating process. Business Services comprises the company internal services and processes which enable the business capabilities. Technical services enabling the operation of the Infrastructure & Data layer are provided by the Infrastructure Services abstraction layer. Questions & KPIs support the cross-cutting element Visions & Goals in order to achieve them. Those cross-cutting elements which are illustrated vertically have an influence on any of the layers. They are needed to successfully run the activities in each layer. It is also important to note that each layer interacts with other elements in the model [24].

It can be said, that every challenge can eventually be addressed by the EA model. To overcome rigid organization structures (C1), the organizational structure of the company with its business processes has to be visualized. For instance, a business capability map can be useful to improve the transparency and show fields of action. Lack of resources (C2) is a general problem in today's industry. Although it cannot be directly solved by EA, it can provide tools to structure and plan available resources. Organizations use business capabilities for team staffing and long-term planing of IT budget [35]. In our interviews, we could identify isolated working behaviour (C3) as one challenge hindering digitalization in public service media industry. Since communication is crucial for inter-organizational cooperation, we can say, that this challenge can also be addressed by the Organization & Process layer. This can be achieved by a business capability model, which can be considered as a reference for public service media. This

would provide a common ground for communication in inter-organizational projects. In the next step, common architecture principles and an application catalogue could improve the knowledge exchange between companies. Unstructured and industry-typical hardware-heavy IT architecture (C4) is the most technical among the mentioned challenges. It seems to be evident that it can be addressed by the Infrastructure & Data layer of the the EA model. Since many devices are coupled to proprietary software we also have to consider the Application layer in this context. By introducing an EA tool and creating a repository the as-is landscape can be documented to identify potential candidates for consolidation. A business capability map can also be useful to improve transparency in the IT landscape. Thus, many companies use visualizations to map their applications and infrastructure components to business capabilities [35]. This can also be helpful in crossmedial distribution (C5) and creating new product lines (C6). By focusing on the company's capabilities instead of the traditional distribution channels (TV, radio and online) editors may be able to think in a more content and thus customer oriented way. Especially, these two challenges are coupled with the companies visions and goals.

VI. Discussion

We now discuss the key findings with reference to the research questions.

- **RQ1:** After investigating the challenges the public service media industry by conducting a structured literature review, we recognized a lack in challenges with regard of digital transformation. In order to fill this gap, we started interviews with different IT-oriented stakeholders. As a result, we are able to provide six challenges which hinder public service media companies in the process of digitalization. First, rigid organizational structures offer no space for innovation. Second, the lack of human and financial resources lead some organizations to cut existing transformation projects. Many companies and divisions still work in silos and show a lack of inter-organizational cooperation. As a consequence, a common knowledge base cannot be accumulated. But it has to be noted, that only half of the interviewees confirm this challenge. Furthermore, unstructured and undocumented IT architecture leads to an increase in IT complexity which reduces agility in meetings new business requirements. This lack of IT documentation can also cause difficulties in crossmedial production. Last but not least, large media companies struggle with reorientation to new customer needs.
- **RQ2:** After identifying the current and mid-term challenges of public service media companies, we used EA to address them. By using the commonly accepted EA layers, we could show that each challenge can at least be partly solved by purposive EA. Special attention has to be paid to the first layer of the EA model (organization & processes) which can address five of six challenges. In particular, business capabilities can be a powerful tool to increase transparency and show fields of action.

VII. Limitation

There exist typical limiting factors for case studies such as validity, generalizability and reliability [5]. It is in the nature of the interview that the results of the individual interviewees are always subjective. Therefore, the result can always be improved by interviewing more companies and people. In this way, new challenges can be identified in addition to existing ones. Besides that, it is certainly difficult to predict future challenges at the time of the interviews. The classification into current and future challenges is a purely subjective opinion of the interviewees.

First, threats to validity mentioned by Runeson and Host (2009) have to be addressed. Construct validity is the criterion which reflects to what extent the operational measures that are studied represent what the researcher intended, and what is investigated according to the research question. To avoid this threat, we interviewed multiple roles across four different companies. However, due to the availability of the interviewees, we focused on IT professionals only. To The second point, internal validity, is not relevant in this case since the conducted case study is an exploratory one and not an explanatory one. To what extent it is possible to generalize the findings is covered by the external validity criterion [5]. We fulfill this requirement by conducting a multiple-case study. Even though results are not to generalize for all media companies, the core outcome of this study can be used for European public service media companies. The fourth criterion by Runeson and Host (2009) is reliability. The purpose of this criterion is to ensure that the results should be the same if the same study was conducted by different researchers. In order to respond to this threat, we paid special attention to describe the case study approach and design as detailed as possible (see section III).

By interviewing different roles and companies we collected data from different sources. Thus, we can allow data triangulation. But unfortunately, the interviews were conducted by one single researcher. This leads to violation of observer triangulation.

VIII. Conclusion and Future Work

New competitors and disrupting technologies such as video on demand services affect the media industry directly. Thus, the aim of this study was to find out, which challenges public service media companies are facing in their digital transformation process. In this context, we also investigated, which EA building blocks are affected by these challenges. For this purpose, we conducted semi-structured interviews in a multiple-case study at four European public media service companies. Our findings indicate that the identified challenges can be divided into current ones and those to appear in the future. So, for many federal organizations typical, rigid organization structure, resource scarcity and silo mentality in departments and domains, have been seen as major challenges which are faced today. Further challenges in the mid or

long term are historically grown, unstructured and hardware-focused IT architecture, crossmediality, and reorientation on new audience needs. Our research is limited since the impact of purposive EAM is only sketched briefly. It has not been observed in practical settings, yet. Thus, for future research appropriate EA methods can be applied to the existing architecture of public service media to measure the extent of success. As future work, the diversity of interviewees can be improved by interviewing additional roles. Furthermore, the challenges we identify are only valid for European public service media companies. This can be extended by conducting similar studies in different industries.

REFERENCES

[1] T. Hess and I. Constantiou, "Introduction to the special issue on digitalization and the media industry," *Electronic Markets*, vol. 28, no. 1, pp. 77–78, 2018.

[2] Y. Sivan and R. Heiferman, "The digital leader: Master of the six digital transformations," *Cutter Consortium, Business Technology Strategies*, vol. 17, no. 2, 2014.

[3] B. Golden, "Cloud computing done the netflix way," https://www.cio.com/article/2397486/cloud-computing-done-the-netflix-way.html, accessed: 2019-05-08.

[4] M. Lankhorst *et al.*, *Enterprise architecture at work*. Springer, 2009, vol. 352.

[5] P. Runeson and M. Höst, "Guidelines for conducting and reporting case study research in software engineering," *Empirical software engineering*, vol. 14, no. 2, p. 131, 2009.

[6] R. K. Yin, *Case study research and applications: Design and methods*. Sage publications, 2017.

[7] H. Leblebici, G. R. Salancik, A. Copay, and T. King, "Institutional change and the transformation of interorganizational fields: An organizational history of the us radio broadcasting industry," *Administrative science quarterly*, pp. 333–363, 1991.

[8] E. Epstein, *News from nowhere: television and the news*, ser. Vintage Political Science and Social Criticism. Vintage Books, 1974.

[9] T. Regan, "Internet as a journalists tool," *Nieman Reports*, vol. 47, pp. 26–30, 1993.

[10] ——, "Technology is changing journalism," *Nieman Reports*, vol. 54, no. 4, p. 6, 2000.

[11] J. G. Stovall, *Web journalism: Practice and promise of a new medium*. Pearson Education, 2003.

[12] I. J. Erdal, "Researching media convergence and crossmedia news production," *Nordicom Review*, vol. 28, no. 2, pp. 51–61, 2007.

[13] A. B. Petersen, "Cross media as innovation strategy: Digital media challenges in the danish broadcasting corporation," *RIPE@ 2008*.

[14] C. Grece, "Trends in the eu svod market," *European Audiovisual Observatory*, 2017.

[15] K. C. Schrøder *et al.*, "Audiences are inherently cross-media: Audience studies and the cross-media challenge," *CM Communication and Media*, vol. 6, no. 18, pp. 5–27, 2011.

[16] J. Van Dijck and T. Poell, "Making public television social? public service broadcasting and the challenges of social media," *Television & New Media*, vol. 16, no. 2, pp. 148–164, 2015.

[17] I. C. Meijer, "Checking, snacking and bodysnatching: How young people use the news and implications for public service media journalism," in *From Public Service Broadcasting to Public Service Media*, G. Lowe and J. Bardoel, Eds. Nordicom, 2007, pp. 167–187.

[18] T. Syvertsen, "Challenges to public television in the era of convergence and commercialization," *Television & New Media*, vol. 4, no. 2, pp. 155–175, 2003.

[19] J. Bardoel, G. F. Lowe *et al.*, "From public service broadcasting to public service media: The core challenge," *From public service broadcasting to public service media*, pp. 9–26, 2007.

[20] R. Ottosen and A. H. Krumsvik, "Digital challenges on the norwegian media scene," *Nordicom Review*, vol. 33, no. 2, pp. 43–55, 2012.

[21] TheOpenGroup, "Togaf enterprise edition - version 9.1," 2011.

[22] S. H. Kaisler, F. Armour, and M. Valivullah, "Enterprise architecting: Critical problems," in *Proceedings of the 38th Annual Hawaii International Conference on System Sciences*. IEEE, 2005, pp. 224b–224b.

[23] R. Winter and R. Fischer, "Essential layers, artifacts, and dependencies of enterprise architecture," in *2006 10th IEEE International Enterprise Distributed Object Computing Conference Workshops (EDOCW'06)*. IEEE, 2006, pp. 30–30.

[24] S. Buckl, "Developing organization-specific enterprise architecture management functions using a method base," Ph.D. dissertation, Technische Universität München, 2011.

[25] J. A. Zachman, "A framework for information systems architecture," *IBM systems journal*, vol. 26, no. 3, pp. 276–292, 1987.

[26] D. H. Olsen, "Enterprise architecture management challenges in the norwegian health sector," *Procedia computer science*, vol. 121, pp. 637–645, 2017.

[27] H. Isomäki and K. Liimatainen, "Challenges of government enterprise architecture work–stakeholders views," in *International Conference on Electronic Government*. Springer, 2008, pp. 364–374.

[28] G. Cousin, *Researching Learning in Higher Education: An Introduction to Contemporary Methods and Approaches*, ser. SEDA Series. Taylor & Francis, 2009.

[29] G. from Knowledge, "Sehdauer pro tag in deutschland," http://www.ard.de/home/die-ard/fakten/ard-mediendaten/Sehdauer_pro_Tag_in_Deutschland_West_und_Ost/408918/index.html, accessed: 2019-05-29.

[30] Statista, "Durchschnittliches alter der zuschauer ausgewhlter fernsehsender," https://de.statista.com/statistik/daten/studie/2120/umfrage/durchschnittliches-alter-der-zuschauer-ausgewaehlter-fernsehsender, accessed: 2019-05-29.

[31] M. Schöenherr, "Towards a common terminology in the discipline of enterprise architecture," in *International Conference on Service-Oriented Computing*. Springer, 2008, pp. 400–413.

[32] S. Kotusev, M. Singh, and I. Storey, "Investigating the usage of enterprise architecture artifacts," 2015.

[33] J. W. Ross, P. Weill, and D. Robertson, *Enterprise architecture as strategy: Creating a foundation for business execution*. Harvard Business Press, 2006.

[34] D. Masak, *Moderne Enterprise Architekturen*. Springer-Verlag, 2006.

[35] P. Aleatrati Khosroshahi, M. Hauder, S. Volkert, F. Matthes, and M. Gernegroß, "Business capability maps: Current practices and use cases for enterprise architecture management," 2018.