Coordination in Enterprise Architecture Management: An Institutional Perspective

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The President:

Prof. Dr. Thomas Bieger

Vorwort

Die vorliegende Dissertation entstand während meiner Tätigkeit als wissenschaftlicher Mitarbeiter am Institut für Wirtschaftsinformatik der Universität St. Gallen (IWI-HSG). In dieser Zeit wurde ich von vielen Personen unterstützt, denen ich an dieser Stelle herzlich danken möchte.

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Neben den oben genannten Personen danke ich insbesondere meiner Familie und meinen Freunden für die immerwährende Unterstützung und den bedingungslosen Rückhalt. Dieses Umfeld gab mir die Kraft und das Durchhaltevermögen, die Dissertation innerhalb der geplanten dreieinhalb Jahre erfolgreich abzuschliessen. Euch allen sei diese Arbeit von ganzem Herzen gewidmet.

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Research Papers

Paper A Brosius, M., and Aier, S. 2016. "The Impact of Enterprise Architecture Management on Design Decisions in IS Change Projects," in *Multikonferenz Wirtschaftsinformatik (MKWI 2016*), Ilmenau, Germany.

Paper B Brosius, M., Haki, K., and Aier, S. 2016. "Themes of Coordination in IS Reference Theories," in *24th European Conference on Information Systems (ECIS 2016)*, Istanbul, Turkey.

Paper C Brosius, M., Haki, K., Aier, S., and Winter, R. 2018. "The Institutional Logic of Harmonization: Local versus Global Perspectives," in *8th Enterprise Engineering Conference* (*EEWC 2018*), *Advances in Enterprise Engineering XII*, Aveiro D., Guizzardi G., Guédria W., Guerreiro S. (eds.), Lecture Notes in Business Information Processing.

Paper D Brosius, M., Haki, K., Aier, S., and Winter, R. 2016. "A Learning Perspective on Enterprise Architecture Management," in *37th International Conference on Information Systems (ICIS 2016)*, Dublin, Ireland.

Paper E Brosius, M. 2016. "Motivation for Coordination – A Complementary Approach to Enterprise Architecture Management Research," in *Trends in Enterprise Architecture Research Workshop (TEAR 2016), 20th IEEE International Enterprise Distributed Object Computing Conference (EDOC 2016)*, Vienna, Austria.

Paper F Brosius, M., Aier, S., Haki, K., and Winter, R. 2018. "Enterprise Architecture Assimilation: An Institutional Perspective," in *39th International Conference on Information Systems (ICIS 2018)*, San Francisco, United States of America.

Summary of Contents

Table of Contents

List of Abbreviations

AIS	Association for Information Systems
AVE	Average Variance Extracted
CIO	Chief Information Officer
CS	Computer Science
EA	Enterprise Architecture
EAM	Enterprise Architecture Management
ECIS	European Conference on Information Systems
EDOC	Enterprise Distributed Object Conference
EDOCW	Enterprise Distributed Object Conference Workshop
EEWC	Enterprise Engineering Working Conference
E.g.	Exempli gratia
ERP	Enterprise Resource Planning
Et al.	Et alii
H	Hypothesis
HOC	Higher-order construct
HTMT	Heterotrait-Monotrait
ICIS	International Conference on Information Systems
ID	Identifyer
IEC	International Eletrotechnical Commission
I.e.	Id est
IEEE	Institute of Electrical and Electronics Engineers
IS	Information Systems
ISO	International Organization for Standardization
IT	Information Technology
KPI	Key Performance Indicator

LOC	Lower-order construct
MIS	Management Information Systems
MIT	Massachusetts Institute of Technology
MKWI	Multikonferenz Wirtschaftsinformatik
n/a	Not available
Nr.	Number
P.	Page
Ph.D.	Doctor of Philosophy
PLS	Partial Least Squares
RQ	Research Question
SEM	Structural Equation Model
TEAR	Trends in Enterprise Architecture Research
TOGAF	The Open Group Architecture Framework
VHB	Verband der Hochschullehrer für Betriebswirtschaft
WoS	Web of Science

List of Figures

List of Tables

Glossary

This chapter contains a glossary, defining the most important terms in this dissertation. The definitions are ordered alphabetically.

Coordination: Act of managing interdependencies among actors (e.g. organizations, organizational stakeholders) to achieve certain goals.

Coordination mechanisms: Means for managing emerged interdependencies, comprising artefacts (e.g. plans) and activities (e.g. planning).

Design decisions: Decisions related to the design of information systems (IS) that support business operations, which constitute and shape an organization's enterprise architecture.

Enterprise architecture (EA): Holistic and integrated view on the organization's entire IS and business landscape, their components, and interrelationships.

Enterprise architecture management (EAM): Management activities of adopting, maintaining, and continuously developing the EA in an organization.

EAM adoption: Establishment of EAM in the organization.

EAM conceptualization: Constitutive artefacts and activities of EAM in the organization, such as frameworks, rules, planning, or control activities.

EAM outcomes: Indication of EAM success and performance benefits in the organization, often measured by IS efficiency (ability to operate under low cost) and IS flexibility (ability to quickly adapt IS to changing business needs). Given EAM's holistic scope, its outcomes are typically measured at the enterprise-wide level.

Enterprise-wide: Dimension referring to the organization as a whole instead of isolated IS or business entities.

Enterprise-wide goals: Desired ends of the whole organization that go beyond local IS or business needs. Examples are cross-unit synergies, standardization, or integration requirements.

Institutional perspective: Derived perspective from institutional theory (neo-institutionalism), aimed at explaining the coordination of organizational behaviour through its institutional environment (which is woven by a web of institutional pressures).

Institutional pressures: Encompassing coercive, normative, and mimetic pressures. Organizational stakeholders adhere to these pressures for gaining legitimacy with their decisions and activities in their institutional environment.

Intra-organizational level of analysis: Level of analysis that focuses entities within the organization rather than inter-organizational relationships.

IS projects: Endeavours to change or purposefully develop one or more IS solutions for specific business needs.

Local: Dimension referring to the lower, more operational levels of the organization. It focuses decision-makers often individually, at the team-, project- or unit-level.

Organizational stakeholders: EAM's targeted decision-makers (mainly on – but not restricted to – the local-level), whose day-to-day decisions constitute and shape the design of the organization's EA.

Top management: Stakeholders of a centralized body in the upper hierarchy of the organization, by whom EAM is excelled, following often a top-down driven fashion.

Abstract

Enterprise Architecture Management (EAM) is a widely discussed approach in information systems research. Its aim is to coordinate locally-focused design decisions of organizational stakeholders towards the consideration of enterprise-wide goals. Despite EAM's growing maturity, organizations encounter institutional obstacles in the realization of EAM outcomes on an enterprise-wide level.

To better explain the realization of these outcomes on an enterprise-wide level, this dissertation opts for an institutional perspective. It thereby seeks to investigate the coordination of organizational stakeholders' design decisions through coercive, normative, and mimetic pressures. Likewise, it seeks to extend explanatory approaches in the existing literature that mainly remain focused on coercive pressures in the conceptualization and organizational adoption of EAM.

Based on empirical data, this dissertation develops a better understanding of EAM outcomes through the influence of institutional pressures. The influence of institutional pressures has been found to occur individually as well as in an interplaying fashion. As a result of these influences, organizational stakeholders develop a greater degree of awareness, understanding, and use of enterprise-wide goals in their design decisions. EAM outcomes are demonstrated to be realized in a successive fashion, i.e. from the local to the enterprise-wide level.

This dissertation's findings lead to a broader and more facilitated understanding of coordination in EAM. The applied institutional perspective draws a coherent picture on institutional pressures within the organization, through which coordination results. In this regard, this dissertation particularly demonstrates the interplaying influence of normative and mimetic pressures that help to better understand the coordination of organizational design decisions as well as the realization of EAM outcomes. Finally, this thesis highlights the role of organizational stakeholders, contributing through their activities (bottom-up) to the successful realization of EAM outcomes. These findings complement existing explanatory approaches in the literature, which mainly remain concentrated on the influence of coercive pressures, especially on the role of top management, for driving the realization of EAM outcomes (top-down).

Keywords: Enterprise architecture management (EAM), coordination, institutional theory, information systems (IS), design decisions

Kurzfassung

Unternehmensarchitekturmanagement (UAM) ist ein weit diskutierter Ansatz in der Informationssystemforschung. Sein Ziel ist die Koordination von lokal-fokussierten Design-Entscheiden organisationaler Akteure zur Berücksichtigung unternehmensweiter Ziele. Trotz steigenden UAM-Reifegrads stossen Unternehmen auf institutionelle Hindernisse in der Realisierung von UAM-Ergebnissen auf unternehmensweiter Ebene.

Zur besseren Erklärung der Realisierung dieser Ergebnisse auf unternehmensweiter Ebene optiert die vorliegende Dissertation für eine institutionelle Perspektive. Dabei soll die Koordination von Design-Entscheiden organisationaler Akteure durch koerzitive, normative und mimetische Treiber untersucht werden. Gleichzeitig sollen bestehende Erklärungsansätze in der Literatur, fokussiert hauptsächlich auf koerzitive Treiber in der Konzeptualisierung und organisationalen Etablierung von UAM, erweitert werden.

Auf Grundlage empirischer Daten entwickelt diese Dissertation ein besseres Verständnis über UAM-Ergebnisse durch den Einfluss institutioneller Treiber. Der Einfluss institutioneller Treiber zeigt sich individuell als auch in Wechselwirkung. Als Folge dieser Einflüsse entwickeln organisationale Akteure einen höheren Grad an Wahrnehmung, Verständnis und Verwendung unternehmensweiter Ziele in ihren Design-Entscheiden. UAM-Ergebnisse zeigen sich sukzessive realisiert, i.e. von lokaler hin zu unternehmensweiter Ebene.

Die Erkenntnisse dieser Dissertation fördern ein breiteres und facettenreicheres Verständnis von Koordination in UAM zu Tage. Die angewandte institutionelle Perspektive zeichnet ein kohärentes Bild von institutionellen Treibern innerhalb der Organisation, durch welche Koordination entsteht. In diesem Zusammenhang zeigt diese Dissertation insbesondere den wechselseitigen Einfluss von normativen und mimetischen Treibern auf, welche dabei helfen, die Koordination organisationaler Design-Entscheide und die Realisierung von UAM-Ergebnissen besser zu verstehen. Schliesslich hebt diese Arbeit die Rolle organisationaler Akteure hervor, welche durch ihre Aktivitäten (bottom-up) zur erfolgreichen Realisierung von UAM-Ergebnissen beitragen. Diese Erkenntnisse komplementieren bestehende Erklärungsansätze in der Literatur, welche sich hauptsächlich auf den Einfluss koerzitiver Treiber, insbesondere des Top-Managements, in der (top-down) Realisierung von UAM-Ergebnissen konzentrieren.

Stichworte: Unternehmensarchitekturmanagement (UAM), Koordination, Neo-Institutionalismus, Informationssysteme (IS), Design-Entscheide

Section A: Research Summary

1 Introduction

The performance of nearly all large organizations depends on the employed information systems (IS) that support the growth and diversity of their business operations (Williams and Karahanna 2013). The larger and more diversified the business operations of organizations, the more likely IS development budgets and project ownerships will be allocated to stakeholders of local business units. While their decisions to design IS solutions (*design decisions*) tend to meet local business needs, they often disregard enterprise-wide goals, such as cross-unit synergies, standardization, or integration requirements (Peterson 2004). As a result, many organizations have to deal with highly complex IS landscapes that require costly alignment and integration efforts (Murer et al. 2010). Hence, it has become an inevitable necessity that organizations foster a more holistic perspective in stakeholders' design decisions, leading them to consider enterprise-wide goals that reach beyond single IS components or specific business needs.

As a solution, IS scholars and practitioners have developed the concept of enterprise architecture (EA). EA refers to a holistic and integrated representation of the organization's entire set of IS and business processes, reflecting enterprise-wide goals, such as integration or standardization requirements (Ross et al. 2006; The Open Group 2018). *EA management* (*EAM*) goes beyond descriptive purposes, referring to management activities for adopting, maintaining, and developing an organization's EA (Aier et al. 2011). To avert the negative implications from an uncontrolled IS evolution resulting in complex IS landscapes, EAM has often been described as a *coordination* approach, referring to efforts for guiding organizational stakeholders' design decisions towards enterprise-wide goals (Weiss 2014). According to Schmidt and Buxmann (2011), coordination in EAM becomes even more decisive, the more an organization relies on the division of labour and the distribution of decision-making authority to develop its IS landscape. In this regard, performance benefits have been measured in *EAM outcomes*, such as IS efficiency or IS flexibility, at the enterprise-wide level (Lange et al. 2016).

1.1 Problem Setting

EAM outcomes. Since the late 1980s, EAM has received increasing attention by IS scholars and practitioners (Simon et al. 2013). Despite EAM's growing maturation, the existing literature continues to report substantial differences regarding the successful

realization of EAM outcomes at the enterprise-wide level (Tamm et al. 2011). On the one hand, differences were found between organizations with similar enterprise-wide goals. While some organizations were successful in adopting EAM, others struggled to derive the intended outcomes and thus perceived their EAM adoptions as a failure. On the other hand, differences were found even within organizations between similar contexts (Dang 2017). Scholars highlighted institutional obstacles that were encountered in adopting EAM on an enterprise-wide basis (Weiss 2014). Concerning literature's reported differences, I conclude that there is a need for a better explanation of the successful realization of EAM outcomes at the enterprise-wide level, which goes beyond existing perspectives that mainly focus on EAM's organizational (context) adoption.

Coordination. Following the association of EAM as an approach to coordinate stakeholders' design decisions for realizing its intended outcomes, the question arises of how coordination and design decisions are analysed in the existing literature. For coordination, there is a wide range of analyses, due to its manifold theorizations in the EAM literature. For instance, Schmidt and Buxmann (2011) analysed means of governance to adopt EAM as a coordination function from an organization theory perspective. Further theories are boundary objects (Abraham et al. 2013), contingency factors (Riege and Aier 2009), or organizational culture (Aier 2014a), applied to analyse mechanisms that coordinate organizational stakeholders from an architectural perspective. Despite the value of the applied theories, the variety of explicit and implicit coordination theorizations makes it difficult to explain the successful realization of EAM outcomes at the enterprise-wide level. This variety is similarly reflected in the IS literature, showing no coherent theoretical body of coordination. Instead, IS literature embodies many borrowed theories from external (e.g. sociology or management science) disciplines (i.e. IS reference theories) that reflect coordination (Malone and Crowston 1990), which may purposefully be applied to EAM. To analyse coordination in EAM, a coherent understanding of coordination – based on IS reference theories – becomes essential.

Design decisions. While there exists a variety of coordination theorizations, so far, little is known about design decisions. In short, a design decision refers to any kind of decision related to the design of one or multiple IS components (e.g. an application or system) and their supported business operation(s) (Plataniotis et al. 2013; 2014). Compared to other phenomena, the coordination of design decisions becomes even more decisive in the EAM context. It thereby requires to focus decisions not only related to the design of IS or business components, but also to holistically scope the sum of organizational decisions constituting and shaping the design of the IS and business landscape: the EA.

To explain coordination in EAM, it becomes necessary to develop an in-depth understanding of design decisions.

1.2 Research Objectives and Research Question Derivation

Building on the identified problem setting, the main research objective is to better explain the successful realization of EAM outcomes by developing a broader perspective on the coordination of design decisions in EAM (RQ3). To this end, I propose two constitutive objectives, targeting a coherent understanding of coordination (RQ2), as well as an in-depth understanding of design decisions (RQ1) upfront (Figure 1).

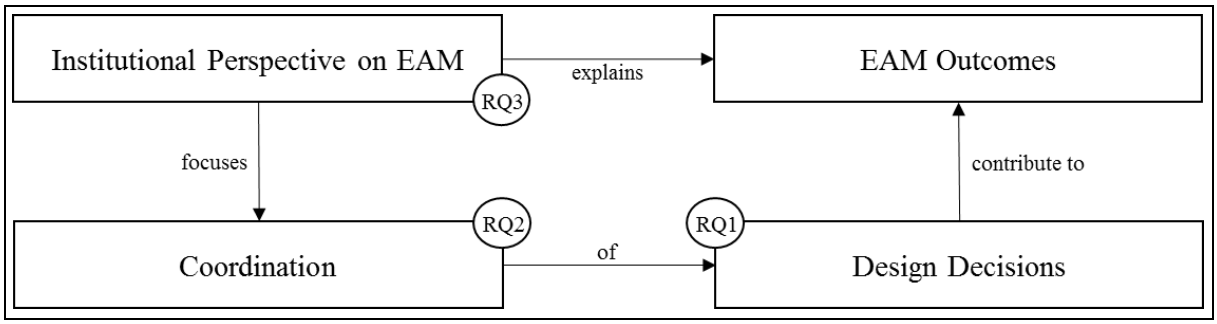

Figure 1: Concept Map

The first part of this dissertation aims to provide a deeper understanding of design decisions. Due to enormously growing IS investments, there is also a growing need to understand design decisions aimed to be coordinated to consider enterprise-wide goals. In the literature, there is a strong relationship between coordinated design decisions and EAM outcomes (Foorthuis et al. 2010; Espinosa et al. 2010; 2011; 2012; Ross and Quaadgras 2012; Winter 2014; Aier et al. 2015). To provide an in-depth understanding of design decisions, it is necessary to consider not only the component level, where decisions are focused on the design of specific IS or business solutions, but to take an enterprise-wide focus on the sum of decisions related to the design of an organization's entire IS and business landscape (the EA). To provide a deeper understanding, I will focus on dimensions (illustrating a holistic view on the sum of decisions related to the design of the EA) and characteristics (illustrating component level design decisions in the EA) of decisions. I propose the following research question:

RQ1: *What are the dimensions and characteristics of design decisions?*

Building on an in-depth understanding of design decisions, the second part of this dissertation aims to develop a coherent understanding of coordination. In the existing literature, there is a great variety of analyses of coordination in EAM due to the diverse use

of IS reference theories[1]. While there is no coherent body of coordination theory (Grant 1996), theories in IS research reflect – in one way or another – coordination (Malone and Crowston 1994). Recognizing the large body of IS reference theories explicitly and/or implicitly reflecting coordination, the second part of this dissertation seeks to develop an IS reference theory-grounded, coherent thematic synthesis of coordination. The corresponding research question is as follows:

RQ2: *What are the themes of coordination in IS reference theories?*

The third part of this dissertation aims to explain the successful realization of EAM outcomes, spotlighting the coordination of stakeholders' design decisions. While the existing literature reports institutional obstacles in adopting EAM, substantial differences were found regarding the realization of EAM outcomes at the enterprise-wide level (Tamm et al. 2011). Differences were shown to exist even between similar contexts within organizations (Dang 2017). Researchers thereby found that EAM outcomes depend not only on contextual, but particularly institutional influences in organizations (Dang and Pekkola 2016). To better understand these institutional influences, scholars have promoted an institutional perspective (Weiss 2014; Dang 2017).

To explain coordination in EAM, this dissertation applies an institutional perspective (Weiss 2014), based on institutional theory. Institutional theory explains the emergence of an institution: a rule-like, social structure in the organizational environment, in which its stakeholders adhere to three types of institutional pressures: coercive, normative, and mimetic (Scott 2014). In a nutshell, these pressures can be perceived as coordination mechanisms, guiding organizational stakeholders in thoughts and actions (Meyer and Rowan 1977) through rules or sanctions (coercive), norms or values (normative), as well as the share of success stories and best practices (mimetic) (Scott 2014). To afford an institutional perspective on coordination in EAM, an intra-organizational level of analysis becomes necessary, focusing on entities within the organization, from which institutional pressures arise. Furthermore, it becomes necessary to take a combined view on all three institutional pressures, which extends existing perspectives in the EAM literature that mainly focus on coercive pressures regarding the development of artefacts and organizational adoption activities. Finally, the activities of organizational stakeholders need to be taken into account. Stakeholders adhere to institutional pressures in their environment, exploring whether and how enterprise-wide goals may suit or advance their

[1] An IS reference theory refers to an applied theory (e.g. institutional theory) from a non-IS discipline (e.g. sociology) to describe or explain IS phenomena (see also Straub 2012).

design decisions. Consequently, EAM remains not only adopted into the organizational context, but becomes an inherent part of its worklife as it ingrains into the organization's institutional microcosm of coercive, normative, and mimetic pressures.

To afford an understanding of how EAM becomes an inherent part of the organization's worklife (by organizational stakeholders considering enterprise-wide goals in their design decisions and therewith contributing successfully to EAM outcomes), the third part of this dissertation aims to answer the following research question:

RQ3: *What is the influence of institutional pressures on the coordination of design decisions in EAM?*

Based on the outlined problem setting, research objectives, and derived research questions, the following part frames this dissertation's research design.

1.3 Research Design and Intended Contributions

The research design of this dissertation consists of an explanatory and a descriptive part. The explanatory part follows the main objective of this dissertation: to develop and propose an institutional perspective on the coordination of design decisions in EAM. The descriptive part provides two constitutive elements of this understanding, focusing on coordination and design decisions (Figure 2). The following two subsections illustrate both parts in detail and conclude with a summary of this dissertation's parts, methodology, and intended contributions.

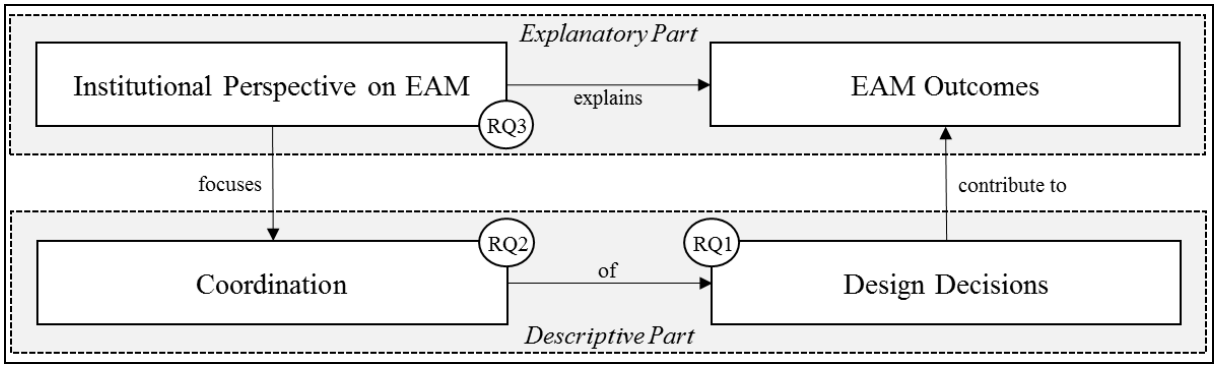

Figure 2: Overview of Research Design

1.3.1 Descriptive Part

To provide a deeper understanding of design decisions, *RQ1* shall be answered with empirical data collected from focus groups. Focus groups are a frequently used method in the IS literature when it comes to exploring new ideas or concepts (Tremblay et al. 2010a). To systematically collect, synthesize, and present the data, a structured research

method for developing a classification scheme will be applied. The ultimate goal is to derive a classification scheme, illustrating several dimensions (for a more holistic view on the sum of decisions constituting and shaping the EA) and characteristics (for a more detailed, component level view) of design decisions (Nickerson et al. 2013).

RQ2 calls for a coherent understanding of coordination. To discover the explicit and implicit reflections of coordination in IS reference theories, RQ2 shall be answered through a thematic analysis approach (Boyatzis 1998). Owing to the large body of theories explicitly or implicitly dealing with coordination, an analysis framework will be constructed at the outset, building on existing definitions and conceptualizations of coordination. This framework will be used for screening IS reference theories, examining how, and from which perspectives, coordination is reflected. Finally, these reflections shall be synthesized into themes, representing manifested, latent patterns of coordination that reflect a coherent understanding of coordination.

1.3.2 Explanatory Part

RQ3 aims to better explain the successful realization of EAM outcomes through an institutional perspective on the coordination of design decisions in EAM. Integrating RQ1 and RQ2, the explanatory part targets an understanding of how EAM becomes a part of the organization's worklife by organizational stakeholders, who adhere to institutional pressures for considering enterprise-wide goals in their design decisions. To answer RQ3, the explanatory part proceeds consecutively in *four steps*, relying on qualitative and quantitative research methods. Combining both methods for answering one and the same research question has proved to be highly promising in IS research (Mingers 2001; Venkatesh et al. 2013).

In the *first step*, a fundamental understanding of the influence of coercive, normative, and mimetic pressures will be provided. This shall be approached through a case study, analysing the influence of pressures for considering enterprise-wide goals in organizational decision-making. The *second step* explores whether and how the consideration of enterprise-wide goals in organizational decision-making contributes to EAM outcomes. This will be undertaken by surveying how stakeholders learn to consider enterprise-wide goals in their decisions and to what extent EAM outcomes will be realized. The *third step* builds on the previous two steps, focusing on the role of stakeholder activities to understand why they would consider enterprise-wide goals in their decisions and which institutional pressures they follow towards this consideration. It relies on a literature review to collect motivation mechanisms for decision-making under the consideration

of enterprise-wide goals, complemented by empirical focus group data. Based on empirical evidence, all three steps shall *finally* be integrated into a concerted research model, reflecting the influence of institutional pressures that lead organizational stakeholders to consider enterprise-wide goals in their decisions, therewith contributing to EAM outcomes. To this end, the research model shall be analysed with empirical survey data to generalize the resulted insights. Table 1 summarizes the research design, its individual parts, research questions, methodology, as well as the intended contributions.

Thesis Part	**Methodology**		**Intended Contributions**
Descriptive Design Decisions (RQ1)	*Qualitative*	▪ Focus group data	▪ Providing an in-depth understanding of design decision
Descriptive Coordination (RQ2)	*Qualitative*	▪ Review of IS reference theories	▪ Providing a coherent, thematic reflection of coordination
Explanatory Coordination of Design Decisions (RQ3)	*Qualitative and quantitative*	▪ Case study data	▪ *Step 1*: Understanding the influence of institutional pressures on organizational decision-making
		▪ Survey data	▪ *Step 2*: Understanding whether and how considering enterprise-wide goals contributes to EAM outcomes
		▪ Literature review, focus group data	▪ *Step 3*: Understanding why and through which pressures stakeholders consider enterprise-wide goals
		▪ Survey data	▪ *Step 4*: Integrating steps 1-3 into a concerted research model for understanding the influence of institutional pressures, by which stakeholders consider enterprise-wide goals in their decisions and thus contribute to EAM outcomes

Table 1: Summary of Research Design and Intended Contributions

1.4 Dissertation Structure

This dissertation is structured as follows: *Section A* provides an overall summary of the dissertation, while *Section B* contains the scientific research papers.

Section A comprises an introduction (chapter 1) to motivate the general background, the problem setting (1.1), research objectives and research question derivation (1.2), as well as the research design (1.3). Chapter 2 lays out the main concepts captured by this dissertation, namely enterprise architecture management (2.1), coordination (2.2), and institutional theory (2.3), as well as their synthesis (2.4). Chapter 3 reviews the related work. Following the outlined research design (Figure 2), this chapter comprises perspectives on explaining EAM outcomes (3.1) as well as – more specifically – the institutional perspective in EAM research (3.2). Chapter 4 contains this dissertation's results, following an overview of contributions to the research questions of the descriptive and explanatory part (4.1) as well as a summary of this dissertation's research papers (4.2). Chapter 5 concludes with a discussion, comprising the main contributions, a critical reflection, limitations, and implications for future research and practice.

Section B proceeds with the individual research papers. The six research papers have been published at renowned international IS conferences. Each of the research papers is presented with its abstract and bibliographical information, including the title, author(s), publication outlet, publication type, publication year, rating[2], and publication status. The research papers have been reformatted to be consistent with the remaining summary paper of this dissertation. The citation format is also unified across all research papers and the summary paper. All tables and figures are uniformly formatted and continuously numbered. All abbreviations, figures, and tables are included within a single list at the beginning of this dissertation, while all references and appendices have been merged at its end.

[2] In this dissertation, I use the ranking of VHB-Jourqual 3.

2 Conceptual Foundation

The following chapter forms the conceptual foundation. To study coordination in EAM from an institutional perspective, this foundation shall be formed around three major blocks: enterprise architecture management, coordination, and institutional theory.

2.1 Enterprise Architecture Management (EAM)

The Open Group (2011) defines *enterprise architecture* as a "formal description of a system, or a detailed plan of the system at component level to guide its implementation," encompassing the "structure of components, their interrelationships, and the principles and guidelines governing their design and evolution over time." In this dissertation, system refers to a socio-technical, organizational environment with a common set of enterprise-wide goals, in which human stakeholders interact with IS to pursue their business operations. This socio-technical environment spans all layers of the business-to-IT stack: the strategic, organizational (processual), alignment, software, and the IT infrastructure layer (Jonkers et al. 2006; Winter and Fischer 2007). Furthermore, all elements of an artefact type (e.g. all process components of a business process) are considered (Lankhorst 2005; Winter and Fischer 2007). Lastly, EA considers all elements of an artefact type on the business-to-IT stack for several points in time, representing the third (i.e. temporal) dimension (Figure 3).

EA management (EAM) goes beyond EA's descriptive purposes and includes activities of adopting, maintaining, and continuously developing an organization's EA (Aier et al. 2011). It seeks to guide locally-focused IS change and development endeavours (e.g. IS projects) in a holistic (see Figure 3) fashion. In this regard, ensuring the conformity of organizational stakeholders' design decisions with enterprise-wide goals has become the main purpose of EAM (Boh and Yellin 2006).

The success and performance benefits of EAM are measured in *EAM outcomes*, most prominently in the form of IS efficiency or IS flexibility at the enterprise-wide level (Lange et al. 2016). IS efficiency refers to an organization's ability to provide the required IS for successfully completing business operations, while minimizing unnecessary redundancies (Schmidt and Buxmann 2011). IS flexibility relates to an organization's ability to quickly adapt its IS landscape to new or changing requirements (Tallon and Pinsonneault 2011).

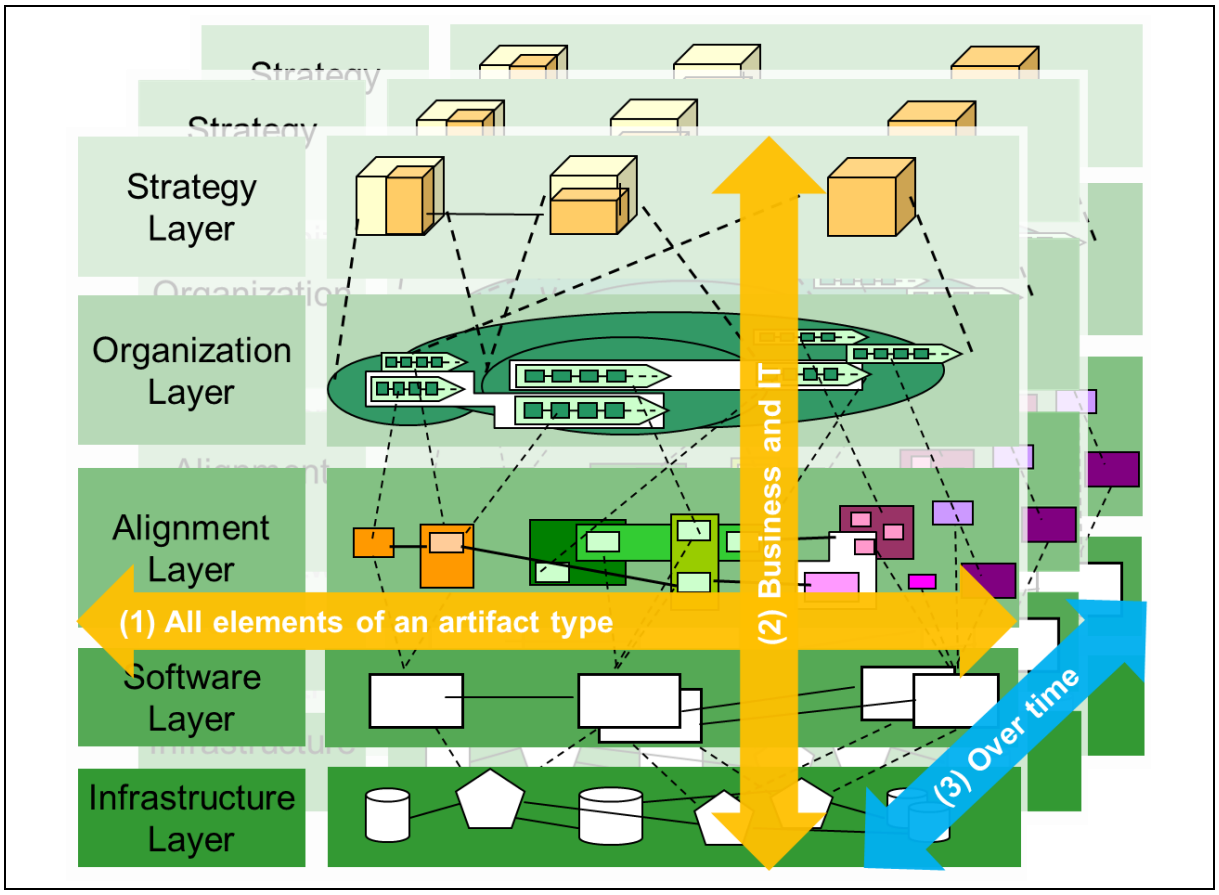

Figure 3: Enterprise Architecture Management (based on Aier 2014b)

2.2 Coordination

The term *coordination* originated from the Latin word "coordinare," meaning "to arrange" and "to put in order." Many disciplines in the IS literature capture definitions and conceptualizations of coordination. However, there is no coherent theory of coordination (Crowston 1997). Rather, there is a developing body of "theories about how coordination can occur in diverse kinds of systems" (Malone and Crowston 1994, p. 1).

This dissertation focuses on the work of Malone and Crowston (1990; 1994), who were among the earliest contributors towards the development of a coordination theory in IS research (Taxén and Riedl 2016). Malone and Crowston (1990, p. 361) proposed two definitions that define coordination as "the act of managing interdependencies between activities performed to achieve a goal" and "the act of working together harmoniously." Based on these definitions, three constitutive elements of coordination (Figure 4) can be derived: *actors*, *interdependencies*, and *mechanisms* (Table 2).

For *actors*, there are different characterizations. Actors (Table 2) can be considered as "individuals" (e.g. employee), "groups" (referring to teams or networks), as well as "organizations" (comprising multiple groups) (Malone and Crowston 1990). "Market" and

"society" may also be considered (Brosius et al. 2016b). "Market" focuses on dependencies or relations between organizations (e.g. industry). Beyond market is the level of "society," which describes different market structures (e.g. nations).

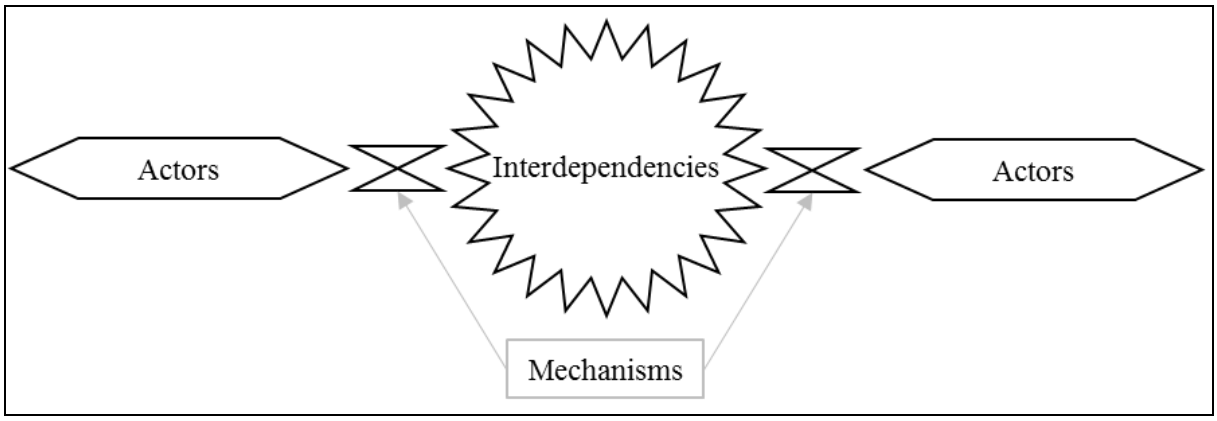

Figure 4: Constitutive Elements of Coordination (based on Malone and Crowston 1990)

Victor and Blackburn (1987, p. 490) define *interdependency* as the extent to which an actor is contingent upon another actor (see also Thomas 1957). Malone and Crowston (1990) distinguish three major sources of interdependencies – goals, activities, and resources – by which actors become contingent upon others (Table 2). Goal is characterized as ends, expectation, or direction, followed by actors in their activities (Crowston 1994). Activity refers to a form of organizing work, such as workflows or processes (Malone and Crowston 1990). A resource can be represented as a physical (e.g. system, machine) or abstract (e.g. knowledge, skill) object (Crowston 1994). Although organization theorists have argued that there is a competitive (i.e. positive) effect of interdependencies (for further details, see Crowston 1994), Malone and Crowston (1990) identify the inherent nature of coordination to reduce and solve interdependencies.

Actors					Inter-dependencies			Mechanisms									
								Formal							*Informal*		
Individual	Group	Organization	Market	Society	Activity	Resource	Goal	Departmentalization	(De-)Centralized Decision-Making	Formalization/ Standardization	Planning	Output/Behaviour Control			Lateral relations	Informal Communication	Socialization

Table 2: Coordination Framework (Brosius et al. 2016b)

In order to exert coordination, research has largely discussed the role of *mechanisms*. Coordination mechanisms refer to artefacts (e.g. physical plans) and activities (e.g. planning processes) "for achieving integration among different units within an organization" (Martinez and Jarillo 1989, p. 490). Mechanisms address problems of interdependencies (Crowston 1997) and "permit coordinated action across a large number of interdependent roles" (Galbraith 1974, p. 28). Malone and Crowston (1990) suggest an overview of mechanisms based on Martinez and Jarillo (1989), who surveyed coordination in multinational corporations and provided a framework of eight mechanisms through the synthesis of prior literature (Table 2). Their framework found a wide uptake in research, favouring its high level of comprehensiveness in addressing actors and interdependencies (e.g. Doz and Prahalad 1991; Ghoshal et al. 1994; Tsai 2002).

Martinez and Jarillo's (1989) framework of coordination mechanisms comprises formal (structural) and informal (subtle) dimensions (see also Brosius et al. 2016b). "Departmentalization" is characterized as a mechanism dealing with the formal structure of the organization (e.g. arrangements of units). "Decision-making" describes forms of command fostered by different levels of hierarchy. Next, there are "formalization and standardization," which describe codified forms of knowledge with a consistent level of quality, "planning" (e.g. functional plans) and "control" (e.g. of behaviour and output) mechanisms. Following Martinez and Jarillo (1989), informal mechanisms comprise "lateral relations," describing direct forms of (e.g. personal, social) contact among individuals. "Communication" refers to forms of informal contact among individuals (e.g. exchange of tacit knowledge). Finally, "socialization" encompasses the organizational culture and social work climate among actors.

2.3 Institutional Theory

Institutional theory attends to the deeper, more resilient aspects of organizational environments (Scott 2014). It seeks to explain how institutions emerge within and across organizations (Meyer and Rowan 1977; Zucker 1977). An institution can be described as a formal or informal "rule of the game" (Scott 2014, p. 344): an authoritative, social structure that guides organizational stakeholders in thoughts and actions (Meyer and Rowan 1977; Scott 2014). Such an institution is composed of three types of institutional pressures (Figure 5) that shape, provide stability, and yield meaning to organizational stakeholders (Orlikowski and Robey 1991). Theory distinguishes *coercive*, *normative*, and *mimetic* pressures (DiMaggio and Powell 1983; Scott 2014).

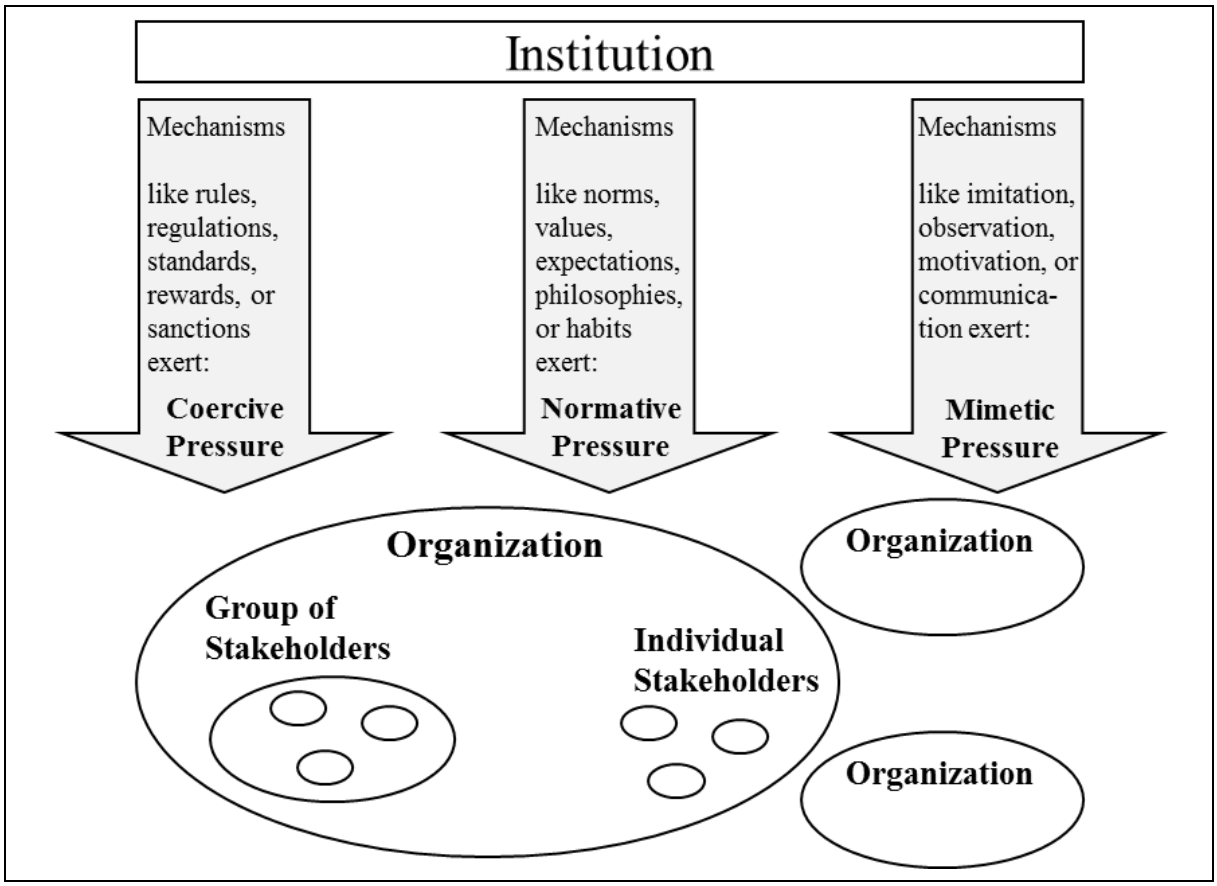

Figure 5: Institutional Theory (adapted from Mignerat and Rivard 2009)

Coercive pressures follow the logic of instrumentality. They regularize and constrain organizational behaviour (Scott 2014), specifying how things must be done. *Normative* pressures impose an obligatory dimension in the organization's worklife (Scott 2014), depicting how things should be done. *Mimetic* pressures stem from common responses to uncertainty by mimicking others' behaviour (Scott 2014). Following the logic of perceived benefits, they reveal how things could be done.

Institutional pressures are carried by different mechanisms, such as activities or artefacts, which are followed by *organizational stakeholders* to gain legitimacy with their decisions and activities (Scott 2014; Suchman 1995). Coercive pressures are carried, for example, by mechanisms of rules and regulations. Stakeholders follow these mechanisms in their decisions and activities, believing that they will advance their interests. Likewise, stakeholders conform to rules and regulations because they seek rewards or try to avoid sanctions (Scott 2014). Normative pressures refer to norms, values, and expectations, representing mechanisms that prescribe how organizational stakeholders are supposed to behave (Scott 2014). Finally, mimetic pressures are carried by observation, imitation, and communication. These mechanisms provide meaning that organizational stakeholders attribute to social behaviour, decisions, and activities. Meaning

arises through the interaction of organizational stakeholders and is further developed when they start to make sense of the ongoing stream of happenings (Scott 2014).

In IS research, institutional theory is among the most dominant and vibrant lenses (Currie and Swanson 2009; Mignerat and Rivard 2009; Orlikowski and Barley 2001). The main body of literature applies institutional theory at the inter-organizational level of analysis, studying how institutions emerge as a result of institutional pressures between organizations (Mignerat and Rivard 2009), industries (Swan et al. 1999), or nations (Silva and Figueroa 2002). Zucker (1987) initially refers to this inter-organizational perspective as the "environment as institution." Likewise, she suggests the "organization as institution," therewith motivating the suitability of institutional theory at the intra-organizational level of analysis (Zucker 1987). However, only a few IS studies have taken it up at this level (Currie and Guah 2007; Gosain 2004; Mola and Carugati 2012). In this regard, several calls have been made in IS research (similar to management science, see Greenwood et al. 2008; Pache and Santos 2013a; 2013b) to apply institutional theory at the intra-organizational level of analysis (Mignerat and Rivard 2009), studying the influence of institutional pressures within organizations (e.g. Currie 2009; Currie and Guah 2007; Gosain 2004; Jensen et al. 2009).

While IS research has largely illustrated that institutional pressures influence organizational behaviour (Mignerat and Rivard 2009), it has less explicitly presented why specific pressures exhibit an influence in the organization while others do not (Currie and Swanson 2009; Mola and Carugati 2012). Indeed, stakeholders are selective over institutional pressures, especially when they are incompatible to their interests or social environment (Mola and Carugati 2012). Jensen et al. (2009) argue that this less explicit consideration roots from institutional studies understanding organizational stakeholders as mere "passive recipients" of institutional pressures (see also Fligstein 2001). What is needed (see also DiMaggio 1988), however, is a more active consideration of stakeholder activities, focusing on "why actors act as they do and what interests motivate them" (Jensen et al. 2009, p. 343). To this end, IS research (similar to management science, see Barley and Tolbert 1997; Thornton and Ocasio 1999) has begun promoting a more explicit consideration of stakeholder activities regarding the influence of institutional pressures (e.g. Liu et al. 2010; 2011; Mola and Carugati 2012).

2.4 Synthesis

To clarify the proposed institutional perspective on coordination in EAM, the following two subsections relate the conceptual foundations of this dissertation (EAM, coordination, institutional theory) to each other. Subsection 2.4.1 focuses coordination in EAM, followed by the institutional perspective on coordination in EAM (subsection 2.4.2).

2.4.1 Coordination in EAM

Following Malone and Crowston (1990), the constitutive elements of coordination comprise *actors*, *interdependencies*, and *mechanisms* (Table 2). In the EAM context, *actors* include representatives of the enterprise-wide level (e.g. enterprise architects, top management) who drive EAM. Also, actors refer to EAM's targeted decision-makers on the (mainly) local level of organizations (e.g. IS projects, business units), involving stakeholders from the IT (e.g. software engineers) and business (e.g. business analysts) side, who shape the EA with their decisions and activities (Brosius et al. 2017).

Interdependencies in EAM exist in the form of goals, as well as goal-related decisions, activities, and resources. Interdependencies exist between the local and enterprise-wide level, within the IT, as well as between the IT and the business side (Brosius et al. 2017). For example, local IS development projects often follow local business goals and may therefore risk disregarding enterprise-wide goals of IS alignment or integration, hence imposing a need for coordination.

In EAM, *mechanisms* refer to artefacts for representing, communicating, and managing the current and future states of the EA, such as models, plans, KPIs, rules, principles, and standards (Aier and Gleichauf 2010; The Open Group 2011; Winter and Fischer 2006). Furthermore, mechanisms in EAM refer to activities, exerted mainly by top management, through which conformity to the EA and its representative artefacts is enforced (Brosius et al. 2017). Control, governance, planning, role definitions, as well as know-how and best practice management, count towards these activities (Aier et al. 2011; Boh and Yellin 2006; Lankhorst 2013; Pulkkinen et al. 2007).

2.4.2 An Institutional Perspective on Coordination in EAM

The institutional perspective of this dissertation explains the coordination of the aforementioned actors and interdependencies (subsection 2.4.1) through taking an institutional account for coordination *mechanisms*. In short, mechanisms are highlighted in the IS and EAM literature as the focal element for explaining the coordination of actors and their interdependencies (Crowston 1997; Brosius et al. 2017). The institutional account

thereby facilitates the analysis of coordination along mechanisms of three institutional pressures to better explain how organizational stakeholders (actors) – following these pressures – consider enterprise-wide rather than solely local goals (interdependencies) in their decisions and activities. This institutional account for coordination mechanisms of the three institutional pressures shall be detailed in the following.

In EAM, *coercive pressures* can be found in artefacts like plans, frameworks, rules, standards, or principles, prescribing enterprise-wide goals that organizational stakeholders are required to follow (see Aier et al. 2011; Haki and Legner 2013b; Richardson et al. 1990). In addition, top management activities, boards, and governance committees are means to exert coercive pressures, enforcing and sanctioning the conformity of stakeholders' decisions and activities to enterprise-wide goals (Boh and Yellin 2006; Boh et al. 2003). *Normative pressures* refer, in the EAM context, to norms, values, and expectations, followed by organizational stakeholders who develop a shared understanding of the value of enterprise-wide goals for their own decisions and activities (Aier 2014a; Faller et al. 2016). When not being appropriately grounded among organizational stakeholders, enterprise-wide goals will lack acceptance and application in decisions and activities (Tamm et al. 2011; Weiss et al. 2013). *Mimetic pressures* occur in the form of observation, communication, and imitation. These activities reflect coordination: they ultimately lead organizational stakeholders to mutually share and absorb knowledge, in effect developing a better understanding of the value of enterprise-wide goals for their decisions and activities (Foorthuis et al. 2010; 2016).

To better explain the successful realization of EAM outcomes at the enterprise-wide level, the institutional perspective of this dissertation chooses an intra-organizational level of analysis. It thereby focuses on entities within the organization (e.g. governance committees), from which institutional pressures arise. While institutional pressures exert a specific coordination influence on their own, it is worth assuming that their influence might also be interrelated. For example, coercive EAM principles may require a normative grounding in the worklife of organizational stakeholders to foster a better understanding of the value of enterprise-wide goals (Aier 2014a). As a result, the institutional perspective of this dissertation takes all three institutional pressures into account, particularly considering the role of organizational stakeholders, who exert and adhere to institutional pressures in their decisions and activities.

3 Related Work

The following chapter contains a review of related work. It reviews perspectives on explaining EAM outcomes. Furthermore, this chapter reviews the institutional perspective in EAM research.

3.1 Perspectives on Explaining EAM Outcomes

For explaining the realization of EAM outcomes at the enterprise-wide level, different research streams have emerged over the past decades. Research started in the early 1980s, focusing on *EAM artefact development*, and gained significant momentum in the late 2000s, shifting its focus to the *organizational adoption of EAM* (Simon et al. 2013). More recently, scholars have proposed perspectives *extending the organizational adoption of EAM* (e.g. Lange et al. 2016; Weiss 2014).

3.1.1 EAM Artefact Development

Early publications focused on the development of artefacts for representing and managing an organization's EA (Schönherr 2004). Prominent examples of EAM artefacts are frameworks, such as the Zachman Framework (Zachman 1987) or The Open Group Architecture Framework (The Open Group 2018), used to plan, implement, and govern the development of an organization's EA. Furthermore, models, plans, and blueprints have been developed for structuring as well as bindingly communicating current and future states of the EA to IS decision-makers (Jonkers et al. 2003; Lankhorst et al. 2004). Finally, standards, rules, and principles represent prominent EAM artefacts for governing IS decision-makers towards enterprise-wide goals (Boh and Yellin 2006; Peristeras and Tarabanis 2000; Richardson et al. 1990).

The conceptualization of EA, captured in EAM artefacts, has been approached in early research mainly from the technical side (Sowa and Zachman 1992). Since the 2000s, research began shifting its technical focus towards more holistic conceptualizations that also comprise the business side, such as business processes or the strategic management level (Winter et al. 2014). Owing to these more holistic conceptualizations, EAM artefacts have become developed more aggregated, sophisticated, and also often more complex in fashion. As a result, a key challenge for EAM has become the (tailored) adoption of these developed artefacts in organizational environments (Aier et al. 2008; Riege and Aier 2009; Ylimäki 2006; Ylimäki and Halttunen 2006).

3.1.2 Organizational Adoption of EAM

Research on adopting EAM in organizations began in the late 2000s. Owing to the variety and interdependencies of IS components that support diverse business processes and organizational stakeholders, the responsibility for managing EA has often been promoted at the top management level (Boh and Yellin 2006). Following a top-down driven fashion, top management has enforced use and conformity towards EA, respectively EAM artefacts, among local decision-makers (Peristeras and Tarabanis 2000). Nevertheless, such coercive, top-down driven coordination approaches have often lacked flexibility in guiding organizational developments, which require significant IS and business changes (Dietz and Hoogervorst 2008). Moreover, the coordination of local IS endeavours, through a centralized organizational body, has often fallen short to adapt to the complexity of the organization's business and IS landscape (Boh and Yellin 2006). In effect, literature has documented many obstacles regarding the successful realization of EAM outcomes, in spite of EAM's growing maturity (Gardner et al. 2012; Löhe and Legner 2014; Tamm et al. 2011).

Scholars addressing how to overcome these obstacles have employed a variety of perspectives. Aier et al. (2011) and Buckl et al. (2010) investigated EAM through situational lenses. The authors found EAM adoption as a situational design and adaption process (see also Haki and Legner 2013b). Haki et al. (2012) investigated the organizational adoption of EAM through contextual perspectives. The authors illustrated diverse adoption approaches in different situations. Driven by the assumption that there is no "one-fits-all" EAM approach for transformation projects in different contexts, Riege and Aier (2009) identified relevant contingency factors and application scenarios (as well as correlations of both) towards a more situational EAM method engineering. While there are specific projects and use cases, there are also specific information needs of organizational stakeholders. Drawing on this challenge, Kurpjuweit and Winter (2007) developed a stakeholder-oriented approach to EAM, focusing on a view-point system for EA modelling and analysis. Lange et al. (2016) studied EAM performance through the lens of critical success factors. Based on a theoretical model, the authors found the enterprise-wide anchoring of EAM as a key success mediator, reflected between EAM outcomes at the project and the enterprise-wide level. Similarly, Schmidt and Buxmann (2011) examined the role of critical success factors. Focusing EAM adoption through the means of governance, they showed several critical success factors influencing the successful realization of EAM outcomes. Finally, Aier (2014a) studied the role of culture in EAM (see also Faller et al. 2016). He found EAM's performance contributions as well as its

applied mechanisms moderated by different levels of group, development, and hierarchical culture.

While the applied perspectives may be suitable to study EAM adoption in specific contexts or situations, they may be less feasible when it comes to explaining the large variance of success regarding the realization of EAM outcomes at the enterprise-wide level (Lange et al. 2016; Tamm et al. 2011). For instance, Schmidt and Buxmann (2011) argue that EAM adoption remains a maturing endeavour for many organizations. As there are different internal stakeholders with different interests, often no common EAM practice has emerged at the enterprise-wide level, thus challenging researchers to measure EAM outcomes at the enterprise-wide level. Moreover, Lange et al. (2016) explained that the existing measures of EAM outcomes largely concentrate on EAM's adoption in the corporate IT, consequently measuring IT-level benefits only, while the business side often remains unconsidered. Finally, Weiss (2014) stated that existing explanatory perspectives largely disregard an organization's worklife, which comprises a variety of social norms, values, and expectations (see also Aier and Weiss 2012b; Dang 2017; Dang and Pekkola 2016). As a result, coercive approaches for adopting EAM would risk nonconformity in the organization when not being compatible with the normative or cultural environment. Likewise, they would remain limitedly successful in contributing to EAM outcomes at the enterprise-wide level. Owing to these shortcomings and to better explain the successful realization of EAM outcomes, scholars have proposed to extend perspectives on the organizational adoption of EAM (Lange et al. 2016; Weiss et al. 2013).

3.1.3 Extending the Organizational Adoption of EAM

"Enterprise architecture is not just for architects" is not only the title of a recent study by Ross and Quaadgras (2012), but also a motivated avenue to extend existing perspectives on EAM organizational adoption (Aier et al. 2015; Winter 2014). Author Jeanne Ross and her colleagues from the Massachusetts Institute of Technology (MIT) studied EAM as a maturity process over several years (Ross 2003; Ross 2006a; 2006b). In 2012, they indicated that higher maturity does not necessarily lead to a higher level of realized EAM outcomes. Given a certain maturity level, organizations should not further invest in the sophistication of EAM artefacts or activities to enforce conformity towards these (Winter 2014). Instead, organizations should support their stakeholders in learning how to consider enterprise-wide goals in their design decisions. Once enterprise-wide goals are considered, stakeholders (on the IT *and the business* side) may successfully contribute to the realization of EAM outcomes at the enterprise-wide level (Winter 2014).

Arguing that the explanatory power of perspectives in the existing EAM literature remains fragmented and incomplete, Lange et al. (2016) argued for a "post-implementation" perspective, where EAM is no longer just organizationally adopted, but becomes understood and used among stakeholders in the organization. In future research, authors should study appropriate cultural, grounding, and boundary spanning mechanisms to better understand EAM's absorption into the organization's worklife and, subsequently, to better explain EAM outcomes (Lange et al. 2016).

Inspired to understand how EAM develops a "rule-like status" that coordinates thoughts and actions of organizational stakeholders, Weiss (2014) proposed an institutional perspective. He argued for the suitability of institutional theory to move researchers' scope beyond "initial" or "developing" EAM stages towards "coordinated" EAM outcomes (Weiss 2014). As his work proposes the uptake of institutional theory on coordination in EAM, which is purposefully aimed by this dissertation, I review his work in the following section, which captures the institutional perspective in EAM research.

3.2 The Institutional Perspective in EAM Research

Literature employing institutional theory in the field of EAM is scarce. In this section, I provide an overview of related work, on which this dissertation builds.

Hjort-Madsen studied EAM from an institutional perspective at the inter-organizational level, focusing on the public sector. He found that the adoption of EA in public agencies is largely influenced by political pressure (Hjort-Madsen 2006). Interoperability becomes essential for managing EA, especially when IS development endeavours span several organizations at different levels of interdependencies. In later case studies, Hjort-Madsen (2007) focused on patterns of EAM adoption, implying that there was also an influence caused by mimetic and normative pressures. On the one hand, imitation (i.e. mimetic) and compliance were found to drive adoption processes. On the other hand, professionalization, norms, and values (i.e. normative) affect the EA in becoming "taken for granted" (Hjort-Madsen 2007, p. 377). Finally, Hjort-Madsen and Pries-Heje (2009) revealed EAM adoption in governments as a process that follows the influence of fashion, politics, and promoted transformation.

Having argued that much research on EAM had been undertaken in terms of artefact development, Haki and Legner (2012) proposed an institutional perspective on the adoption of EAM principles at the intra-organizational level. Given the context-dependent

focus of EAM research, the authors favoured institutional theory as a broad and encompassing lens to spotlight EAM adoption not only in specific settings or situations, but throughout the whole organization.

Weiss (2014) was among the first to apply an institutional perspective in EAM research at the intra-organizational level. He concentrated on how architectural coordination institutionalizes as a "rule-like practice" in organizations. By reviewing existing literature, as well as different case studies, he identified several antecedents to the institutionalization of architectural coordination and its contributions to EAM outcomes at the enterprise-wide level (see also Aier and Weiss 2012a; 2012b). Based on a theoretical model with developed measurement items (Weiss and Winter 2012), Weiss empirically confirmed the influence of seven institutional antecedents, predicting the institutionalization of architectural coordination, as well as their influence on the successful realization of EAM outcomes (Weiss et al. 2013).

Dang (2017) studied the institutionalization of EA by multiple case studies from an intra-organizational perspective, focusing mainly on the public sector. He explained that the adoption of EA and its related outcomes, within organizations, are shaped by a web of rules, norms, and values that affect their institutionalization (see also Dang and Pekkola 2016). Dang (2017) further stressed the role of organizational stakeholders. Through stakeholders' activities in the process of EA institutionalization, success rates of realized outcomes may be particularly increased.

Relying on complex adaptive systems and institutional theory as research lenses, Beese (2018) developed a simulation model to theorize on the evolution and guidance of IS architecture complexity under different, purposefully manipulated combinations of institutional pressures. He proposed the guidance of complex IS architectures as an act of balancing top-down control and bottom-up emergence through institutional pressures individually as well as their dynamic combinations (Beese 2018).

This dissertation aims to achieve a purposeful application of institutional theory in order to develop a better understanding of coordination in EAM (extending organizational adoption perspectives) and its related, enterprise-wide outcomes. Inspired by the work of Weiss (2014), Dang (2017), and Beese (2018), this dissertation aims to apply institutional theory at the intra-organizational level of analysis. At the intra-organizational level, it seeks to analyse the influence of institutional pressures, which guide organizational stakeholders to eventually consider enterprise-wide goals in their decisions. As institutional pressures guide thoughts and actions of organizational stakeholders, they

may be perceived as a threefold microcosm of coordination mechanisms underlying organizational environments, upon which this dissertation builds to afford a broader, more facilitated perspective on coordination in EAM. Regarding the influence of institutional pressures, the work of Hjort-Madsen (2006; 2007) as well as Dang and Pekkola (2016) lays out a first coverage of coercive, normative, and mimetic pressures. Concluding that there may not solely be an individual influence of institutional pressures in large and complex organizational environments, this dissertation additionally follows Beese (2018) towards a combined consideration of the influence of institutional pressures. As such, the influence of institutional pressures may emerge complementarily, meaning that pressures can arise in different combinations or dependencies to each other, as implied by Beese (2018). Furthermore, this dissertation follows Weiss (2014), Dang (2017), and Beese (2018), promoting the role of stakeholder activities on the influence of institutional pressures. While Weiss (2014) highlighted the consideration of stakeholder activities through strategic response strategies (see also Oliver 1991), Dang (2017) and Beese (2018) argued that the influence of institutional pressures is not a static scaffolding in organizational environments. While institutional pressures are prevailing in organizational environments, their influence is carried, spread, and shaped by organizational stakeholders, contributing actively to the successful realization of EAM outcomes at the enterprise-wide level (Beese 2018; Dang 2017).

4 Results

The following chapter contains this dissertation's results. Section 4.1 provides an overview of its research papers, their interrelations, and contributions to the descriptive (subsection 4.1.1) and explanatory (subsection 4.1.2) part. Section 4.2 contains the summarized content of each individual paper.

4.1 Overview of Contributions

Table 3 provides a high-level view on the papers' contributions to the three research questions, which shall be explained in detail in the following two subsections.

	Descriptive Part		**Explanatory Part**			
	Research Paper A	Research Paper B	Research Paper C	Research Paper D	Research Paper E	Research Paper F
RQ1	●					
RQ2	◑	●				
RQ3		◑	●	●	●	●
Overview of research questions: **RQ1**: What are the dimensions and characteristics of design decisions? **RQ2**: What are the themes of coordination in IS reference theories? **RQ3**: What is the influence of institutional pressures on the coordination of design decisions in EAM?						
Legend: ● *Main contribution to research question* ◑ *Partial contribution to research question*						

Table 3. Overview of Contributions

4.1.1 Descriptive Part (RQ1, RQ2)

RQ1 aims for an in-depth understanding of design decisions. To this end, *Paper A* (subsection 4.2.1) contributes an identification of 18 dimensions and 46 characteristics of design decisions (*main contribution to RQ1*), shedding light on "what" shall be coordinated. Based on the identified dimensions and characteristics, the paper derives two

types of design decisions, each revealing a specific mode on "how" decisions need to be coordinated (*partial contribution to RQ2*). Type 1 implies the suitability of hierarchical, formal coordination mechanisms on design decisions. Type 2 complementarily suggests lateral, informal mechanisms to coordinate design decisions in EAM.

RQ2 is concerned with a coherent understanding of coordination. Therefore, *Paper B* builds on existing definitions of coordination, as well as on the identified (formal and informal) categories of coordination mechanisms in Paper A, to constitute an analysis framework for reviewing theoretical literature that reflects coordination. Paper B (subsection 4.2.2) makes two contributions to this dissertation. Firstly, it provides a theory-grounded, thematic reflection of coordination (*main contribution to RQ2*), consisting of four themes: informing (e.g. coordination through information exchange), socializing (e.g. coordination through social relations), controlling (e.g. coordination through ruling and regularizing behaviour), and legitimating (e.g. coordination through informing, socializing, and controlling themes). Secondly, Paper B discovers a complementary relation between these themes, upon which "legitimating" represents a broad, overarching, and integrating frame, in which all other coordination themes interplay. The theme legitimating is particularly promoted by institutional theory, which understands organizations as social constructions that seek to gain legitimacy. It reflects coordination in coercive (e.g. controlling theme), normative, and mimetic pressures (e.g. informing theme, socializing theme). Hence, institutional theory and its promoted institutional pressures were identified as a suitable research lens for developing this dissertation's aimed perspective on coordination in EAM (*partial contribution to RQ3*).

4.1.2 Explanatory Part (RQ3)

Through the lens of institutional theory (Weiss 2014), **RQ3** seeks to analyse the influence of institutional pressures on the coordination of design decisions in EAM. Following the presented research design (subsection 1.3.2), RQ3 will be answered in four steps. Firstly, the explanatory part analyses the influence of institutional pressures on organizational decision-making (Paper C). Secondly, it explores whether and how the consideration of enterprise-wide goals, in the decisions of organizational stakeholders, contributes to EAM outcomes (Paper D). Thirdly, the explanatory part sheds light on the activities of organizational stakeholders, i.e. why they consider enterprise-wide goals in their decisions and which institutional pressures they follow in doing so (Paper E). Finally, these steps shall be integrated into a concerted research model that spotlights the influence of institutional pressures, under which organizational stakeholders consider

enterprise-wide goals in their decisions and thereby contribute to EAM outcomes at the enterprise-wide level (Paper F).

Paper C (subsection 4.2.3) investigates the influence of institutional pressures prevailing in the organizational environment. It finds an individual influence of each institutional pressure on the coordination of organizational decision-making (*main contribution to RQ3*). In addition, Paper C reports an interplay of institutional pressures, discovering that they influence each other (*main contribution to RQ3*), which occurs from mimetic to normative pressures, and from normative to coercive pressures. These findings not only lead to a broader understanding of coordinated organizational decision-making through the influence of different mechanisms of institutional pressures, but also to a better understanding of how institutional pressures are shaped and constrained in their influence (e.g. mechanisms of coercive pressures depending on normative pressures; mechanisms of mimetic pressures enabling normative pressures). Paper C provides additional explanation on the influence of institutional pressures through the activities of organizational stakeholders (*main contribution to RQ3*). Stakeholders were found to follow institutional pressures and thereby leverage their (individual, combined, and interplaying) influence (bottom-up) across functional units and hierarchical levels in the organization. In particular, stakeholders actively negotiate institutional pressures, such as normative pressures in the form of norms, values, and expectations. Through activities of mimicking, observing, and communicating, stakeholders spread (distinctive as well as negotiated) goals, values, norms, and expectations throughout the organization. In turn, coercive pressures (e.g. organizational strategy) mainly reflect negotiated (normative) expectations, goals, and needs of organizational stakeholders.

To study whether and how the consideration of enterprise-wide goals contributes to the realization of EAM outcomes, *Paper D* (subsection 4.2.4) follows recent discourses that promote EAM as a learning mechanism, in which organizational stakeholders learn to consider enterprise-wide goals in their decisions (Aier et al. 2015; Ross and Quaadgras 2012; Winter 2014). Paper D thereby makes two contributions. The first is the empirical demonstration of EAM as a learning mechanism, in which cooperative knowledge acquisition and collaborative interaction lead organizational stakeholders to consider enterprise-wide goals in their decisions, which contributes to the successful realization of EAM outcomes (*main contribution to RQ3*). The second contribution is added explanation to the successful realization of EAM outcomes through the activities of organizational stakeholders, which Paper D empirically demonstrates via a mediation effect. This

mediation effect shows that the successful realization of EAM outcomes at the enterprise-wide level strongly depends on the realization of EAM outcomes at the project (i.e. local) level. As stakeholders learn and interact with one another (e.g. with those from other projects or units), they leverage the realization of EAM outcomes (bottom-up) from the local to the enterprise-wide level (*main contribution to RQ3*).

Paper C and D highlight the role of stakeholder activities to provide additional explanation on the coordination of organizational decision-making (Paper C) as well as on the successful realization of EAM outcomes (Paper D). Yet, from an institutional perspective, little is known about why stakeholders "act as they do and what interests motivate them" (Jensen et al. 2009, p. 343). Therefore, *Paper E* (subsection 4.2.5) provides an understanding of stakeholders' motivation to better explain why they consider enterprise-wide goals in their decisions and which institutional pressures they follow in doing so. Through the lens of stewardship theory, Paper E contributes to this dissertation with a collection of five groups of situational and psychological motivation mechanisms, explaining why organizational stakeholders consider enterprise-wide goals in their decisions (*main contribution to RQ3*). Moreover, these motivation mechanisms (e.g. rewards, norms, values, culture, and climate) reflect coercive, normative, and mimetic pressures, demonstrating that stakeholders follow all three institutional pressures for considering enterprise-wide goals in their decisions. While Paper E supports the general suitability of institutional theory, this dissertation further argues, due to the large and diverse set of followed mechanisms by organizational stakeholders (see also Paper C), for a combined view on all three institutional pressures to better explain coordination in EAM.

Paper F integrates the previous findings into a concerted research model to develop the overall aimed, better understanding of coordination in EAM and its related outcomes at the enterprise-wide level. To this end, Paper F spotlights the concept of assimilation (EA assimilation), in which awareness, understanding, and use of enterprise-wide goals in organizational decision-making contribute to the successful realization of EAM outcomes. For explaining EA assimilation, the influence of coercive, normative, and mimetic pressures is considered. Furthermore, the activities of organizational stakeholders are considered for better explaining the relation between institutional pressures and EA assimilation. Overall, Paper F makes three contributions to this dissertation. Firstly, it empirically demonstrates that the extent to which enterprise-wide goals become recognized, understood, and used among organizational stakeholders depends on the influence of all three institutional pressures (*main contribution to RQ3*). This demonstration

goes beyond existing perspectives in the EAM literature, which mainly focus on specific artefacts or adoption activities, to explain the coordination of stakeholders' decisions and activities. Secondly, recognized, understood, and used enterprise-wide goals among organizational stakeholders were empirically demonstrated to contribute to the successful realization of EAM outcomes at the enterprise-wide level (*main contribution to RQ3*). Thirdly, the activities of organizational stakeholders were empirically demonstrated to mediate the relation between institutional pressures and EA assimilation. This mediation helped to better explain how EAM outcomes result, following a successive (bottom-up) realization from the local to the enterprise-wide level (*main contribution to RQ3*). These findings mark the highlight of this dissertation's institutional perspective on coordination in EAM.

4.2 Research Papers of the Dissertation

The following subsections summarize this dissertation's published research papers. Citation, research objective, research method and procedure, as well as the results are provided with each paper.

4.2.1 Paper A

Citation

Brosius, M., and Aier, S. 2016. "The Impact of Enterprise Architecture Management on Design Decisions in IS Change Projects," in *Multikonferenz Wirtschaftsinformatik (MKWI 2016)*, Ilmenau, Germany.

Research objective

The objective of Paper A was to provide an in-depth understanding of design decisions. This includes characteristics for understanding design decisions at the component level as well as dimensions towards a more holistic scope of design decisions in the EA context. Building on the eventually resulting characteristics and dimensions, Paper A further aimed to identify design decision types in order to understand how to reconsider EAM as well as its applied mechanisms for coordinating design decisions more successfully towards EAM outcomes.

Research method and procedure

We used focus groups as a method to collect data from EA managers, relying on a structured research design for empirical data collection. This structured design built on Nick-

erson et al.'s (2013) method for taxonomy development in information systems, providing the steps for the development of a classification scheme to group and categorize design decisions into characteristics and dimensions. A representative sample of 31 design decisions, requiring coordination in EAM, was collected. Based on this sample, we followed an iterative classification development process.

Results

We developed a classification scheme with 46 characteristics and 18 dimensions (summarized to three groups), each following a certain (nominal or ordinal) scale type (see Table 4).

Group	Dimension	Illustrative Characteristics			Scale
Decision	Decision properties	Critical/political	Relevant	Not relevant	*Nominal*
	Decision nature	Attractive	Not attractive		*Nominal*
	Decision driver	Collective	Selective	Individual	*Ordinal*
	Decision object	Process	Software	Infrastructure	*Nominal*
	Decision quality	Fact-based	Personal Feeling		*Nominal*
	Level of documentation	Distinct	Partial	Unincisive	*Ordinal*
Decision Process	Decision process maturity	High	Low		*Ordinal*
	Decision-maker competency	Comprehensive	Generalized	Specialized	*Nominal*
	Decision-maker hierarchy	Executive-level	Middle-level	Low-level	*Ordinal*
	Decision-maker locality	Central	Unit-specific	Local	*Ordinal*
	Informality	Low	High		*Ordinal*
	Implementation	Instruction	Guideline	Recommendation	*Nominal*
	Reach of decision	Cross-departmental	Local		*Ordinal*
Decision Impact	Decision bindingness	Mandatory	Partially binding	Open	*Ordinal*
	Range of impact	Enterprise-wide	Organizational unit		*Ordinal*
	Decision-maker allocation	Global	Heterogeneous	Homogenous	*Nominal*
	Impact over time	Unlimited	Limited		*Nominal*
	Acceptance	General	Unequal		*Ordinal*
Explanation:		Hierarchical	Lateral	Not differentiating	

Table 4. Characteristics and Dimensions of Design Decisions (Brosius and Aier 2016)

Based on this scheme, we revisited the EAM literature to identify those decision characteristics, on which EAM is known to have a coordinating impact as well as those not addressed by the main body of the EAM literature. This led us to identify two distinctive design decision types that embody *hierarchical* and *lateral* characteristics (a few dimen-

sions were not meaningful for a differentiation). We found the hierarchical design decision type suitable to coordination by formal, top-down driven mechanisms. Complementarily, we found the lateral design decision type suitable to informal, decentralized coordination mechanisms. Based on these two design decision types, we concluded that there is a need for a broader perspective on coordination in EAM. In particular, for coordinating design decisions more successfully towards EAM outcomes, *formal*/hierarchical as well as *informal*/lateral coordination mechanisms need to be considered complementarily. Paper B will build on the complementarity of formal and informal coordination mechanisms in an analysis framework to develop a coherent understanding of coordination.

4.2.2 Paper B

Citation

Brosius, M., Haki, K., and Aier, S. 2016. "Themes of Coordination in IS Reference Theories," in *24th European Conference on Information Systems (ECIS 2016)*, Istanbul, Turkey.

Research objective

Paper B aimed to develop a coherent understanding of coordination. Notwithstanding its decisiveness for the EAM discipline, there is, generally speaking, no coherent body of coordination theory in the IS literature (Crowston 1997; Malone and Crowston 1990). To develop a coherent understanding of coordination, Paper B aimed to conduct a thematic analysis, synthesizing implicit and explicit reflections of coordination in IS reference theories.

Research method and procedure

We constructed an analysis framework by building on the most common definitions of coordination (Malone and Crowston 1990; 1994; Van de Ven et al. 1976) as well as on the identified (formal and informal) categories of coordination mechanisms in Paper A (see also Martinez and Jarillo 1989). The framework included actors, interdependencies, and mechanisms. Using the analysis framework, we conducted a structured thematic analysis (Boyatzis 1998), synthesizing themes of coordination from IS reference theories. In total, 16 theories were screened and filtered from the *Theories Used in IS Research Wiki* (Larsen et al. 2015), a list that scholars from the international IS community contributed to (Lim et al. 2009; Straub 2012).

Results

We discovered four themes of coordination: informing, socializing, controlling, and legitimating. A description of the themes, their purpose of coordination, as well as illustrative examples are provided in Table 5.

Theme	Purposes of coordination: *Illustrative example*
Informing	• Information exchange: *Information acquisition and application in decision-making processes (e.g. Levitt and March 1988)* • Dynamic information facilitation: *Interaction for knowledge creation and facilitation throughout the organization (e.g. Nonaka 1994)* • Bridging dissimilar/asymmetric levels of information: *Achieving a basis for common understanding (e.g. Star and Griesemer 1989)*
Socializing	• Achieving collective benefits: *Social networks upheld for collectively-shared goals (e.g. Olson 1965)* • Achieving social relations: *Social integration by the formation of networks (e.g. Granovetter 1973)*
Controlling	• Mitigating expected negative effects resulting from goals that are not collectively shared: *Contract between principal and agent against negatively expected effects through the agent's behaviour (e.g. Jensen and Meckling 1976)* • Harmonizing not collectively shared goals: *Values and norms established towards desired conceptions, by which behaviours can be compared (e.g. DiMaggio and Powell 1983)*
Legitimating	• Harmonization by cultural and normative patterns: *Taken-for-granted character of culture among those who follow, adapt, or change it (e.g. Schein 2010)* • Harmonization by dynamic patterns: *Interplay among actors changing structures, and the structures changing the interactions of actors (e.g. Giddens 1984)* • Harmonization by environmental factors: *Organizations becoming legitimized systems by producing social behaviour, and being reproduced by this behaviour (e.g. DiMaggio and Powell 1983)*

Table 5. Themes of Coordination in IS Reference Theories (Brosius et al. 2016b)

We further discovered a complementary relationship between the themes, captured by an overarching theme: legitimating. More generally, this theme represents an embedding scheme for mechanisms of the themes informing, socializing, and controlling, targeting

the gain of legitimacy. According to Paper B, legitimating and its constitutive mechanisms are concretely reflected in institutional theory. In general terms, institutional theory builds on the assumption that organizations are social constructions, in which organizational behaviour is guided by mechanisms of coercive, normative, and mimetic pressures, driven by the need of gaining legitimacy. We therefore identified institutional theory as a suitable research lens for developing this dissertation's aimed perspective on coordination in EAM. Building on Paper B, coercive, normative, and mimetic pressures, in particular, represent the mechanisms of coordination in this perspective, which shall be taken up in the explanatory part.

4.2.3 Paper C

Citation

Brosius, M., Haki, K., Aier, S., and Winter, R. 2018. "The Institutional Logic of Harmonization: Local versus Global Perspectives," in *8th Enterprise Engineering Conference* (*EEWC 2018*), *Advances in Enterprise Engineering XII*, Aveiro D., Guizzardi G., Guédria W., Guerreiro S. (eds.), Lecture Notes in Business Information Processing.

Research objective

Paper C aimed to develop a fundamental understanding of the influence of institutional pressures on the coordination of organizational decision-making. Following the call for applying institutional theory at the intra-organizational level of analysis (Mignerat and Rivard 2009), Paper C focused on entities within the organization, from which institutional pressures arise. Furthermore, Paper C considered the activities of organizational stakeholders, eventually exerting, shaping, or constraining the influence of pressures.

Research method and procedure

To study the influence of institutional pressures from an intra-organizational level of analysis, we opted for a case study of a highly-decentralized organization. Data were collected via primary sources: twelve semi-structured interviews were conducted with different local (i.e. lower hierarchy) and global (i.e. upper hierarchy) decision-makers from both the business and IT side (e.g. CIO, vice-presidents, business and IT unit heads). Furthermore, data were collected via secondary sources, such as organigrams, (annual) reports, strategy documents, and role descriptions. The data were then coded and analysed through a scheme-based approach, focused on (mechanisms of) institutional pressures (Scott 2014).

Results

For each institutional pressure, we discovered an individual influence. For example, coercive pressures represent an orientation frame for coordinated decision-making. Mechanisms of coercive pressures (e.g. corporate vision, strategies) are being followed in the organization because they reflect what stakeholders commonly share as valued ends. Normative pressures mainly result from distinctive norms and values of specific market segments, which are supplied by stakeholders. Distinctions are then negotiated and disappear due to a mutually-generated identity. Finally, mimetic pressures rise as local unit members perceive the best practices of their fellow stakeholders as benchmarks and begin to imitate their successful counterparts. Communication channels enable and support mimetic behaviour within and across local units, triggering the negotiation of norms, values, and expectations throughout the entire organization.

Furthermore, we identified an interplay of institutional pressures (being mutually constitutive and leveraging), which rises from mimetic to normative pressures, and from normative to coercive pressures. In this interplay, the influence of pressures is carried successively by organizational stakeholders who mimic the best practices of organizational counterparts, leading to the (bottom-up) spread of shared norms and values among stakeholders throughout the organization. In effect, stakeholders become motivated to enter mutual negotiations of their distinctive norms and values. In turn, negotiated mechanisms of normative pressures are reflected in mechanisms of coercive pressures (e.g. organizational strategy). Consequently, Paper C highlights not only the influence of institutional pressures occurring individually, combined, and interplaying, but also the activities of organizational stakeholders, who carry the influence of pressures throughout the organization.

4.2.4 Paper D

Citation

Brosius, M., Haki, K., Aier, S., and Winter, R. 2016. "A Learning Perspective on Enterprise Architecture Management," in *37th International Conference on Information Systems (ICIS 2016)*, Dublin, Ireland.

Research objective

Paper D aimed to study whether and how the consideration of enterprise-wide goals in organizational decision-making contributes to the realization of EAM outcomes. To this end, we focused on EAM as a learning process, in which organizational stakeholders

cooperatively learn to consider enterprise-wide goals in their decisions. Building on cooperative learning as a decentralized process within and across local IS projects, EAM outcomes were measured at both the project (i.e. local) and the enterprise-wide level.

Research method and procedure

A research model, based on how cooperative learning contributes to EAM outcomes, was constructed. It consisted of two major blocks: the learning process (knowledge acquisition as a prerequisite for cooperative learning) and its contributions to EAM outcomes (IS efficiency and IS flexibility at the project, i.e. local, and the enterprise-wide performance level). The research model was operationalized with measurement items from the existing EAM and cooperative learning literature, creating a survey with 151 collected responses. The responses were then analysed using a partial least squares (PLS) approach to structured equation modelling (SEM) and tested for validity and reliability, as suggested by Hair Jr. et al. (2014).

Results

In Paper D, we empirically demonstrated the successful realization of EAM outcomes at both the project/local and enterprise-wide level through organizational stakeholders, who consider enterprise-wide goals in their decisions. Moreover, we highlighted the important role of stakeholder activities: while EAM outcomes result at the enterprise-wide level, they depend on the successful realization of EAM outcomes at the local (i.e. project) level. In this regard, we empirically demonstrated a mediation effect of stakeholder activities, showing the (bottom-up) leverage of EAM outcomes from the local to the enterprise-wide level. Figure 6 shows the SEM, comprising its constructs (dark bubbles), R^2-values (small white boxes), and hypothesized relations (arrows) with their path coefficient and significance level.

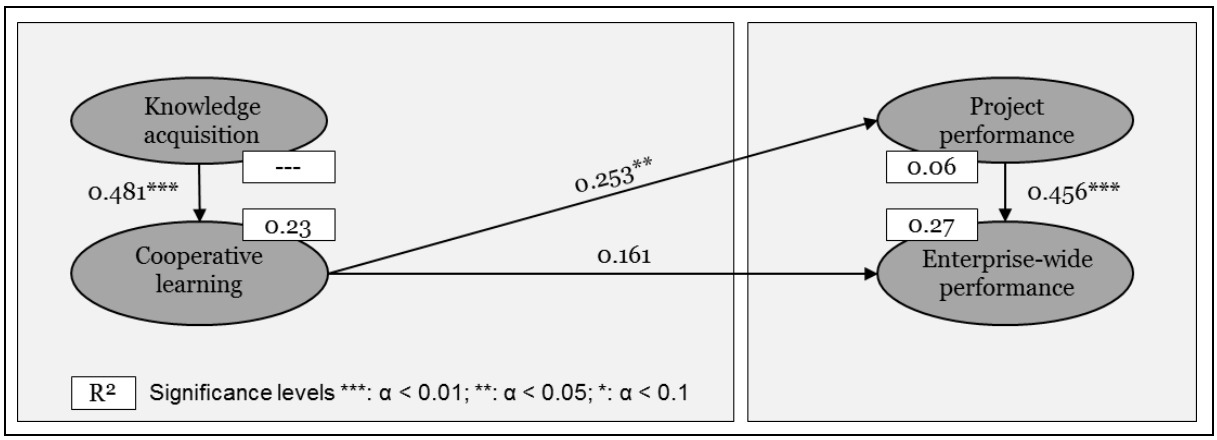

Figure 6: A Learning Perspective on Enterprise Architecture Management (adapted from Brosius et al. 2016a)

4.2.5 Paper E

Citation

Brosius, M. 2016. "Motivation for Coordination – A Complementary Approach to Enterprise Architecture Management Research," in *Trends in Enterprise Architecture Research Workshop (TEAR 2016), 20th IEEE International Enterprise Distributed Object Computing Conference (EDOC 2016)*, Vienna, Austria.

Research objective

Paper E aimed to develop a better understanding of stakeholder activities, i.e. why they consider enterprise-wide goals in their decisions and which institutional pressures they follow towards this consideration. With this approach, Paper E further aimed to add explanation to an underrepresented aspect in institutional IS research, which is "why stakeholders act as they do and what motivates them" (Jensen et al. 2009, p. 343).

Research method and procedure

Through the lens of stewardship theory, I conceptualized the model of a decision-maker, being motivated to consider enterprise-wide goals. In effect, I differentiated motivation along five groups of psychological and situational mechanisms. Psychological mechanisms comprised intrinsic causes (motivation through the realization of higher order needs) and identification (motivation through the feeling of belonging). Situational mechanisms covered work-environmental factors, such as the philosophy of management (motivation through the involvement of decision-makers), culture (motivation through the style of working), and power distance (motivation through the distribution of leadership). Based on this differentiation, I conducted a literature review for collecting motivation mechanisms, enriched and validated by empirical focus group data from senior EA practitioners.

Results

I identified a large and diverse set of motivation mechanisms, explaining why organizational stakeholders consider enterprise-wide goals in their decisions (Table 6).

Motivation Mechanisms	**Literature Review**	**Focus Group**
Identification	Shared norms, values, enjoyment, inspiration, degree of creativity	Culture, mindsets, personal ambitions

Management philosophy	Trust, reliability, credibility, kinship	Security of job and workplace, co-management, autonomy
Monetary mechanisms	Direct financial rewards, opportunity cost	Salary, bonus payments, career benefits
Use of power	Status, reputation, recognition, career, and experience gains	Climate (discussions, participation in decision-making)
Intrinsic causes	Higher order needs (learning, training, knowledge)	---

Table 6. Motivation Mechanisms (Brosius 2016)

Moreover, these motivation mechanisms reflect institutional pressures, such as coercive (e.g. monetary mechanisms, see Paper C), normative (e.g. identification, see Paper C), and mimetic pressures (e.g. the use of power, see Paper C). Demonstrating that stakeholders follow a large and diverse set of mechanisms of all three institutional pressures (see also Paper C), I concluded that there is a need for a combined view on the influence of all three pressures to better explain coordination in EAM. This combined view on the influence of all three pressures will be taken up in Paper F.

4.2.6 Paper F

Citation

Brosius, M., Aier, S., Haki, K., and Winter, R. 2018. "Enterprise Architecture Assimilation: An Institutional Perspective" in *39th International Conference on Information Systems (ICIS 2018)*, San Francisco, United States.

Research objective

Based on the constitutive findings of Paper C, D, and E, Paper F aimed to develop a concerted research model towards a better understanding of coordination in EAM. Therefore, Paper F chose to focus on the concept of assimilation. The concept of assimilation (referred to as EA assimilation in the following) is used to explain the extent to which enterprise-wide goals are ingrained into locally-focused design decisions of organizational stakeholders (referred to as local stakeholders in the following) and so contribute to the realization of EAM outcomes (referred to as EA outcomes in the following) at the enterprise-wide level.

Research method and procedure

In line with the institutional IS literature, we explained EA assimilation through the influence of institutional pressures, considering coercive, normative, and mimetic pressures, as well as their relation to EA assimilation. As local stakeholders follow these pressures for considering enterprise-wide goals in their decisions (see Paper C and E), we considered the engagement of local stakeholders as mediating the relation between institutional pressures and EA assimilation (see Paper D). Finally, we analysed the outcomes of EA assimilation (see also Paper D).

The research model was operationalized with measurement items adapted from the existing IS institutional, IS assimilation and EAM literature. A survey was created and 134 responses collected. The research model was tested for validity and reliability criteria, being analysed through a SEM-PLS (see also Paper D) approach (Hair Jr. et al. 2014).

Results

In Paper F, we empirically demonstrated the influence of institutional pressures that lead organizational stakeholders to consider enterprise-wide goals in their decisions, which contributes to the successful realization of EAM outcomes. As promoted by Paper C and E, the combined view on all three institutional pressures helped to look beyond individual coordination mechanisms of EAM, which is dominant in the existing literature. In this regard, the influence of all three pressures was demonstrated to be positively related to EA assimilation. The engagement of local stakeholders helped to better explain the relation between institutional pressures and EA assimilation: stakeholders, who consider enterprise-wide goals in their decisions, contribute successively (bottom-up) to the realization of EA outcomes at the enterprise-wide level (see also Paper C and D). Figure 7 shows the SEM, comprising its constructs (dark bubbles), R^2-values (small white boxes), as well as hypothesized relations (arrows) with their path coefficient and significance level.

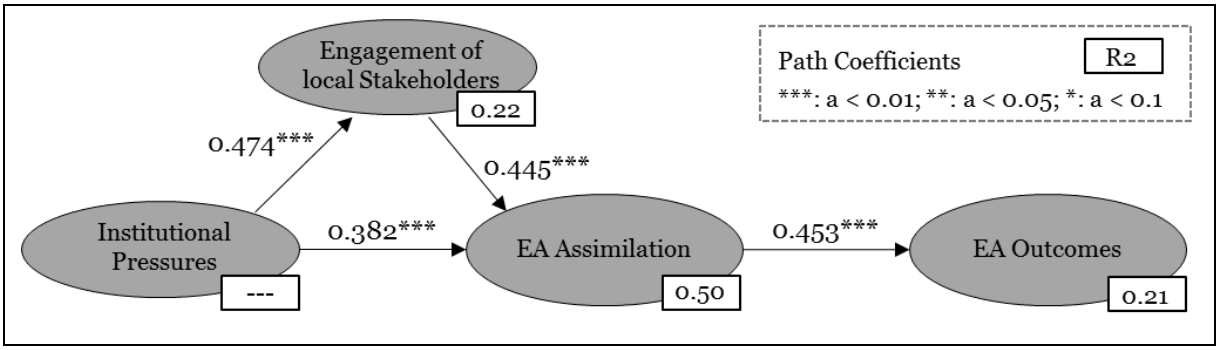

Figure 7: EA Assimilation (adapted from Brosius et al. 2018a)

5 Discussion

Over the past decades, EAM has been studied in the IS literature as a maturing approach, aimed at coordinating the design decisions of organizational stakeholders. The existing literature mainly focused on the development of artefacts and adoption activities for bringing EAM into the organization. Owing to substantial differences reported in the successful realization of EAM outcomes, this dissertation focused on how EAM becomes a part of the organization. By applying an institutional perspective on coordination in EAM, this dissertation analysed how the consideration of enterprise-wide goals in the design decisions of organizational stakeholders contributes successfully to EAM outcomes at the enterprise-wide level.

In the following, this dissertation's main contributions, a critical reflection, limitations, as well as implications for future research and practice will be reviewed.

5.1 Contributions

To the first research question, this dissertation presents a classification scheme with a total of 18 dimensions and 46 characteristics, summarized to three groups (decision, decision process, decision impact). The scheme reveals a more profound and in-depth understanding of design decisions, which to date remain only fragmentally explored in the existing literature. Furthermore, two types of design decision were derived from the classification scheme. Type 1 was found suitable to coordination by top-down driven, sophisticated, and formal mechanisms. Complementarily, type 2 was found suitable to coordination by lateral, less sophisticated, rather informal mechanisms. While formal mechanisms (type 1) are well-reflected in the existing EAM and coordination literature, particularly type 2 raised the need for a broader and more coherent perspective on coordination in EAM.

To the second research question, four theory-grounded themes were reported. Informing reflects coordination in the exchange of information for bridging dissimilar levels of knowledge. It refers to the basis of a shared understanding, upon which information becomes applied in decision-making and thereby leads to coordinated interaction. Socializing reflects coordination in lateral, social relations. It refers to shared goals, shared expectations, and social integration that bring about a network of coordinated interaction. Controlling reflects coordination in regularizing behaviour and sanctioning the non-conformance to collective goals. Finally, the theme legitimating reflects coordination as an overarching frame, in which informing, socializing, and controlling interplay.

Legitimating is particularly promoted by institutional theory, reflecting coordination as a result of coercive (e.g. controlling), normative and mimetic pressures (e.g. informing, socializing). To the existing literature, which mainly describes how coordination occurs in diverse settings (Malone and Crowston 1994), these themes afford an orthogonal, thematic reflection that brings about a more coherent understanding of coordination. Based on the theme legitimating and its constitutive mechanisms, institutional theory was identified as a suitable research lens, proposing institutional pressures to develop this dissertation's aimed perspective on coordination in EAM.

To the third research question, this dissertation makes three contributions. Firstly, it empirically demonstrates an individual and combined influence of institutional pressures on the coordination of organizational decision-making. While pressures' influence has been widely reflected in the existing IS literature between organizations (Mignerat and Rivard 2009), this dissertation confirms their influence from a new angle, focusing pressure-exerting entities and stakeholders within the organization. Secondly, this dissertation discovers an interplay of pressures, in which their influence was found mutually constitutive and leveraging. Moreover, their interplaying influence raises throughout the organization from mimetic to normative, and from normative to coercive pressures. These findings not only contribute new insights, they also offer a vantage point to derive avenues for future research. Thirdly, this dissertation provides additional explanation on the influence of institutional pressures through the activities of organizational stakeholders. Stakeholders are found to follow institutional pressures, being motivated to learn and explore whether and how enterprise-wide goals support or advance their decisions. In effect, stakeholders develop greater awareness, understanding, and use of enterprise-wide goals for their decisions, which this dissertation demonstrates to contribute to the successful realization of EAM outcomes. Moreover, stakeholder activities are demonstrated to successively leverage EAM outcomes in the organization, i.e. from the local to the enterprise-wide level (bottom-up). These findings, at last, complement the existing literature, which mainly focuses on the role of top management (e.g. Boh and Yellin 2006) for driving the coordination of stakeholders' design decisions (top-down).

5.2 Critical Reflection

Explaining the successful realization of EAM outcomes through the influence of institutional pressures brought about new findings to the existing literature; however, some aspects remain unaddressed. The applied intra-organizational perspective, focusing on entities within the organization, proved to be a solid angle, since the discovered pressure

influences correspond to findings of existing, inter-organizational perspectives (Brosius et al. 2018b). Furthermore, it led to the discovery of an interplay among institutional pressures. This, however, could not be empirically generalized. It may be due to the heterogeneity of underlying mechanisms, through which pressure influences are conveyed within (from context to context) and across organizations. Also, pressures are dependent on one another, not only within, but also between, certain levels of analysis. Dependencies may stem from government (e.g. laws), industry (e.g. established standards), or public agency (e.g. regulatory reporting requirements) pressures, which directly constrain stakeholders, their decisions and activities within organizations. Therefore, the results of this dissertation, as well as the existing literature, could have benefited from a closer examination of the interplay of institutional pressures, thereby particularly considering pressure influences from entities outside the organization.

In the existing literature, discussions on coordination remain not limited to mechanisms that address interdependencies among actors. While mechanisms are at the core of coordination theory, they are also outlined as the focal element for explaining the outcomes of coordination that result. The existing coordination theory literature has documented a wide range of outcomes, such as the integration of tasks or appropriateness of resources, when it comes to achieving certain goals under labour division (Malone and Crowston 1990). While the findings of this dissertation do not add more differentiated outcomes from a coordination theory perspective, they could still have benefited from a more tailored investigation of coordination outcomes from an institutional theory perspective (e.g. resulting legitimacy of activities or taken-for-grantedness of decisions). Notably, the existing literature could have also profited from a deeper, institutional examination of coordination outcomes and its related explanation of EAM outcomes.

While much research on coordination in EAM remains design-centric, this dissertation opted for an explanatory approach. It thereby explained the successful realization of EAM outcomes and did not specify the role of particular artefacts or adoption activities. For future design-centric research, however, proved successful artefacts or adoption activities contributing to the explained outcomes might offer a vantage point to (re-)design or evaluate EAM in organizational contexts with its prevailing institutional influences. For instance, some EAM artefacts and adoption activities may work successfully in a certain constellation of institutional pressures, while facing obstacles in another. Consequently, this dissertation, managerial practice, as well as future research could have benefited from specifying the generated explanatory findings regarding EAM artefacts and adoption activities.

Over the past decade, the corporate IT of many large organizations has undergone several developments regarding its organization of work. More flexible and autonomous forms of working, such as self-managing teams (Leroy et al. 2015), agile modes of operation (Kude et al. 2014), or two-speed IT management (Horlach et al. 2016) continue to grow inside and outside corporate EAM functions. While focusing on the organization of work in-/outside EAM from a rather generic perspective, the findings of this dissertation could have profited from providing more concrete vantage points to real-world IT work environments. EAM as well as non-EAM practitioners (solving similar EAM challenges) may have profited from implications in how far the findings of this dissertation apply to recent developments in today's IT work organizations. Likewise, this dissertation could have benefited from better explaining EAM outcomes by considering the forms of organizing work, along which EAM outcomes were measured.

5.3 Limitations

This dissertation has limitations. To *RQ1*, an understanding of dimensions and characteristics of design decisions is provided. Owing to its enterprise-wide focus, this dissertation took a holistic view on design decisions, focusing on the sum of organizational decisions that are related to the design of the IS and business landscape, rather than decision characteristics, which focus specific IS or business designs at component level. Due to this holistic view, the derived types of design decisions and implications for coordination remain at a certain level of abstraction, differentiating only between formal/hierarchical and informal/lateral mechanisms, which were taken up to answer RQ2. While concluding that the findings (i.e. the influence of institutional pressures) on organizational decisions do generally apply at the component level, further specifications could bring about a more detailed understanding of how to coordinate design decisions that are focused on the design of individual IS or business solutions.

To *RQ2*, this dissertation caters a thematic analysis. To feasibly cope with the large amount of theoretical literature (16 IS reference theories), the thematic analysis followed a standardized review procedure. This procedure considered the most common reflections of actors, interdependencies, and mechanisms in each respective theory, however, limited in-depth analyses as well as further specifications. Furthermore, only IS reference theories were considered, i.e. theories that have been applied in IS research. Hence, their specific applications in EAM research were not considered. Prospective research may further specify the (theoretical and thematic) understanding of coordination, particularly for the EAM context (see also Brosius et al. 2017).

To *RQ3*, this dissertation offers an analysis of the influence of institutional pressures on the coordination of design decisions. Regarding the influence of institutional pressures and the successful realization of EAM outcomes, the underlying conceptualization of EAM was not considered. However, the realization of EAM outcomes largely depends on the conceptualization of EAM, such as on adopted artefacts, their level of abstraction and sophistication (Labusch and Winter 2013; Lankhorst 2013). Prospective research may consider EAM conceptualizations more explicitly, taking into account how these conceptualizations eventually moderate EAM in becoming part of the organization's worklife and realizing its intended outcomes.

While this dissertation's findings (on the individual and combined influence of institutional pressures) were supported and generalized by empirical survey data, the discovered interplay of institutional pressures was based on a single case study. Hence, the generalizability of this interplay remains limited as organizations differ by contextual (e.g. organizational structure, work processes, hierarchies) and social factors (e.g. values, norms, belief systems). Future research may generalize the interplay of institutional pressures via different interplay scenarios by further case studies, enriching qualitative data and conducting cross-case analyses. Regarding the findings of stakeholder activities, it must also be taken into account that organizations differ by personal motives of their respective stakeholders, through which they also respond differently to institutional pressures (Oliver 1991; Suchman 1995). While building on a review of literature and focus group data, further data collection (and cross-validation) is necessary to enrich the understanding of stakeholders, i.e. how and why they consider enterprise-wide goals in their decisions and activities, through which they contribute to EAM outcomes.

An overall limitation of this dissertation is not to consider timeliness. However, spotlighting how EAM becomes an inherent part of the organizational worklife is an enduring process over historic developments, conflicts, and unforeseen events. As a result, also the successful realization of EAM outcomes is a continuous, evolving, and recursive process that develops over time (Haki and Legner 2013a; Ross 2006b). Based on this dissertation's findings, future research may add a longitudinal perspective to improve the understanding of the influence of institutional pressures, the coordination of stakeholders' design decisions, as well as the successful realization of EAM outcomes.

5.4 Implications

The findings of this dissertation offer several research and managerial implications, which shall be discussed in the following.

5.4.1 Research Implications

This dissertation highlights institutional theory and coordination as complementary research lenses. On the one hand, coordination is manifested in several themes (most importantly in legitimating), thereby reflecting actors in interdependencies and mechanisms to manage these. These manifestations, in turn, are shown to guide the selection and application of theoretical lenses – such as institutional theory – on coordination. On the other hand, institutional theory specifies the constitutive elements of coordination (actors, interdependencies, mechanisms) for a more detailed analysis. In particular, institutional pressures account for a better understanding of the underlying mechanisms through which coordination unfolds. Consequently, future research may continue to develop the understanding of coordination based on its complementarity to other (e.g. IS reference) theories, contributing to an integrated, meta-theoretical body of coordination (see also Malone and Crowston 1990; 1994). Likewise, the application of institutional theory on coordination-related phenomena, such as in the EAM context, may be further detailed (see also Abraham et al. 2012; Weiss 2014).

To date, the discourses in IS research that apply institutional theory mainly refer to the inter-organizational level of analysis, investigating the influence of institutional pressures from one organization to another, between industries, or nations (Mignerat and Rivard 2009). This dissertation complements prior research: it follows several calls from the root discipline of institutional theory (Dacin et al. 2002; Greenwood and Hinings 1996; Pache and Santos 2010; 2013b) and IS research (Gosain 2004; Jensen et al. 2009; Mignerat and Rivard 2009; Mola and Carugati 2012) by empirically demonstrating the influence of institutional pressures from entities within the organization, taking an intra-organizational perspective. Building on these demonstrations, future research may continue to explore the influence of institutional pressures on new levels of analysis from an intra-organizational perspective. New levels may comprise the individual actor, team, unit, or department level. Prospective research may also study the influence of pressures between different levels in an organization to provide further insights on their interplay, as discovered in this dissertation.

This dissertation captures a combined view on institutional pressures to explain how EAM becomes an inherent part of the organization's worklife, highlighting the complementarity of their influence. Building especially on the findings of Paper C, D, and F, future research is advised to consider particularly normative and mimetic pressures when it comes to explaining the realization of EAM outcomes. Even studies focusing a mere coercive approach to EAM can benefit from considering normative and mimetic

pressures complementarily, which are prevailing in organizational environments and may thus support, shape, or even constrain EAM artefacts as well as (top management) activities for EAM adoption.

A more exclusive focus on normative or mimetic pressures in organizations could be approached through the design of artefacts and activities to guide the institutionalization of enterprise-wide goals in organizational decision-making. For normative pressures, research may focus, for instance, on the design of communication-related artefacts or activities that support the sharing and negotiating of different (local) norms, values, and expectations towards enterprise-wide goals (see also Paper C and F). For mimetic pressures, research may focus, for example, on the design of artefacts or activities to support the communication of success stories or the sharing of best practices based on decisions that consider enterprise-wide goals (see Paper C and F).

The institutionalization of enterprise-wide goals in organizational decision-making may be followed by a deinstitutionalization process (i.e. discontinuity, see Zucker 1987). While this dissertation focuses on institutional effects rather than institutionalization processes, it necessary to become aware of the fact that the influence of institutional pressures as well as the consideration of enterprise-wide goals may change, decrease, or even discontinue (see also Haunschild and Chandler 2008). To investigate such changes, decreases, and discontinuances, scholars have focused on strategic responses to institutional pressures (Mignerat and Rivard 2009). Oliver (1991) hereby outlines a typology of five strategic responses. These include acquiescence (i.e. conformity), compromise, avoidance, defiance, and manipulation. While this dissertation promotes the role of conformity (Paper D, Paper E) and compromise (Paper C) for following institutional pressures, future research may investigate how, and under which circumstances, responses of avoidance, defiance, or manipulation may lead stakeholders to discontinue the consideration of enterprise-wide goals in decision-making. Furthermore, research may examine through which strategic responses the discontinuances of enterprise-wide goals in organizational decision-making can be repaired.

To better understand discontinuances of enterprise-wide goals as well as strategic responses to institutional pressures, Oliver (1991) further suggests to study personal motives. A common assumption on organizational stakeholders is that they follow individual motives (such as their own goals, values, norms, or expectations) and smuggle these into their institutional environment (Oliver 1991). As a result, organizations become infused with multiple, often competing rationales about which pressures and goals to follow and how to organize work activities appropriately (Ocasio 1997; Thornton and

Ocasio 1999). It therefore becomes necessary to understand the (formal and informal) rationales of action among stakeholders, i.e. why they adhere to certain pressures prevailing in their environment. The so-called institutional logic focuses on the formal and informal rationales of action among organizational stakeholders (Thornton and Ocasio 1999). Institutional logic helps to explain the successfulness or conflicts of institutional pressures in place (Friedland and Alford 1991). Building on Paper C, future research may investigate the institutional logic among organizational decision-makers for continuing and discontinuing the consideration of enterprise-wide goals, exploring what rationales specifically support the successful realization of EAM outcomes at the enterprise-wide level.

5.4.2 Managerial Implications

The findings of this dissertation are as equally important to EAM practice. Firstly, it is necessary for EA managers to become aware of the microcosm of rules, norms, values, and beliefs that underlie organizational work environments. In this regard, institutional pressures may support, weaken, or inhibit managerial attempts to foster EA conformity. Hence, managers need to understand how the development and adoption of EAM approaches may depend on the pervasive influence of underlying institutional pressures. Furthermore, EA managers need to develop appropriate (response) strategies that may involve the co-adaptation of prevailing (mechanisms of) institutional pressures and adopted EAM approaches towards the successful realization of EAM outcomes.

As demonstrated in this dissertation, stakeholder activities play an important role in successfully realizing EAM outcomes. Moreover, stakeholders' influence on realizing these outcomes rises as they are enabled and motivated to consider enterprise-wide goals in their decisions. Hence, EA managers should be less concerned with coercive approaches to control, rather than empowering, motivating, and training organizational stakeholders in learning to consider enterprise-wide goals for their decisions. This implication follows recent discourses in the EAM literature, proposing lightweight and less sophisticated mechanisms to support the consideration of enterprise-wide goals in stakeholders' design decisions throughout the organization (Ross and Quaadgras 2012; Winter 2014). EA managers may grant more design decision freedom and autonomy to organizational stakeholders, thereby increasing the intrinsic acceptance and continuous consideration of enterprise-wide goals. Stakeholders, in turn, may benefit from greater design decision freedom and autonomy to individually explore how enterprise-wide goals may suit or enhance their respective design decisions (Brosius et al. 2016a; Winter 2014).

Finally, this dissertation aims to propose EAM as a continuous and longitudinal process. Managers focusing on how adopted EAM approaches may become an inherent part of the organization's worklife need to understand that EAM outcomes at the enterprise-wide level may not be realized instantaneously (see also Paper C, Paper F). Instead, managers should perceive EAM as an emerging, recursive, and long-term effort (Haki and Legner 2013a; Ross 2006b) that requires time to unfold its intended outcomes.

Section B: Research Papers of the Dissertation

Paper A – The Impact of Enterprise Architecture Management on Design Decisions in IS Change Projects

Title	The Impact of Enterprise Architecture Management on Design Decisions in IS Change Projects
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Table 7: Bibliographical Metadata on Paper A

Abstract

Information systems (IS) change projects aim at developing consistent IS solutions for business needs. In order to avoid inconsistencies, redundancies, and misalignments among these projects, some form of cross-project guidance is needed. Enterprise architecture management (EAM) is a prominent discipline that aims to guide IS change projects not only for local business needs, but also for enterprise-wide and long-term goals. However, EAM's impact often remains limited due to the complexity of IS landscapes, conflicting goal systems, and design decisions that cater local/short-term rather than enterprise-wide/long-term solutions. Assuming that EAM does not necessarily guide all these potentially relevant design decisions in IS change projects, we explore dimensions and characteristics of design decisions based on empirical focus group data. To this end, we develop a classification scheme, based on which we identify two design decision types that embody hierarchical and lateral characteristics, respectively. Using this

scheme, we discuss how to (re-)consider EAM for enterprise-wide/long-term solutions in IS change projects.

Keywords

n/a

A.1 Introduction

An increasing number of information systems (IS) change projects in today's organizations create solutions focusing a short-term/local rather than a long-term/enterprise-wide perspective (Aier et al. 2015; Gardner et al. 2012). A frequently discussed reason is the complexity of the corporate IS landscape (Abraham and Aier 2012; Boh et al. 2003; Weiss et al. 2013): Large organizations often implement hundreds of IS landscape changes every year, affecting a large number of applications that support various depending and interrelated business processes. Design decisions on even small changes affect a potentially large number of business processes, workflows, applications, and more generally a larger group of stakeholders and their respective goals (Murer et al. 2010). Additionally, these IS changes occur not only sequentially, but also in parallel, which potentially leads to inconsistencies among applications, processes and infrastructure components on an enterprise-wide level (Abraham and Aier 2012; Lankhorst 2005; Winter and Fischer 2007). Credit Suisse, a global bank, may serve as an illustrative example: Between 1995 and 2005, individual solutions for regionally heterogeneous business processes were developed individually, having generated inconsistencies, redundancies, and misalignment, and eventually fallen short in creating an enterprise-wide consistent IS landscape in the following years (Murer et al. 2010). In other words, design decisions for IS changes that target local optima do not necessarily generate a beneficial solution on the enterprise-wide/long-term level.

For several years, enterprise architecture management (EAM) has been researched and applied as a means for holistically guiding IS change projects towards consistent solutions on the enterprise-wide IS landscape (Aier et al. 2011; Buckl et al. 2009; The Open Group 2018; Winter and Fischer 2007). However, extant research found that EAM's impact remains limited in IS change projects and does supposably not reach all potentially relevant design decisions in these projects (Gardner et al. 2012; Ross and Quaadgras 2012; Winter 2014). While prior research has often valued the effects of EAM (Abrams et al. 2006), we assume, in line with Winter (2014), Aier et al. (2015) as

well as Ross and Quaadgras (2012), that design decisions are generally a core object for achieving IS change solutions on an enterprise-wide and long-term basis.

The purpose of this study is to analyze design decisions in IS change projects. We aim to identify dimensions (e.g., acceptance of decision) and the respective characteristics (e.g., general acceptance, unequal acceptance) of design decisions in order to provide an instrument for scholars and practitioners for analyzing design decisions and their potential contribution to enterprise-wide and long-term IS solutions. Therefore, we proceed as follows: First, we review extant literature in order to position EAM as a means for achieving enterprise-wide IS solutions. Next, we collect and analyze focus group data for developing a classification scheme of design decision dimensions and characteristics in IS change projects. Based on this scheme, we identify design decisions types, and discuss how to (re-)consider EAM for achieving enterprise-wide and long-term goals through these design decisions. Implications and limitations are concluded in the final section.

A.2 Enterprise Architecture Management

Enterprise architecture (EA) is defined as the "organizing logic for business processes and the IT infrastructure, reflecting integration and standardization requirements" of an organization (Ross et al. 2006, p. 9). It has been largely developed by academic research and practitioners for descriptive usages, such as EA modeling (Buckl et al. 2009; The Open Group 2011). The traditional perspective of EAM goes beyond these descriptive approaches by aiming at prescriptively guiding IS change projects (Aier et al. 2015; Boh et al. 2003). These changes are often a necessary reaction to external influences on the organization (Teece et al. 1997), such as "opportunities, threats or unforeseen events" (Rouse 2006, p. 16).

EAM contributes to an organization's overall goal system by managing IS change endeavors (Lankhorst 2005; Winter and Fischer 2007) for increasing the corporate IS landscape effectiveness, manageability, and consistency (Schmidt and Buxmann 2011; Winter 2014) with a holistic perspective rather than focusing on local/short-term solutions (Aier et al. 2011). This holistic perspective reaches out in the organization for horizontal, vertical, and time dimensions (Lankhorst 2005; Winter and Fischer 2007). In these dimensions, (horizontally) all artifacts per artifact type (e.g., all applications) and (vertically) all layers of the business-to-IT stack (e.g., applications running on certain

IT infrastructure and being used in certain business processes) are considered; furthermore, EAM considers these dimensions for several points in time. EAM typically approaches its holistic scope by artifacts like meta-models, models, plans and roadmaps, and coordination mechanisms, such as rules, norms, or guiding principles (Aier et al. 2015; Winter 2014). These artifacts and coordination mechanisms are mainly driven from a centralized position in the hierarchy of an organization, following a top-down direction (Aier 2014a; Asfaw et al. 2009; Gardner et al. 2012).

Despite activities for developing and institutionalizing EAM in the organization (Gardner et al. 2012; Tamm et al. 2011; Weiss et al. 2013), established EAM functions still fall short of their expected contribution in practice (Ross and Quaadgras 2012; 2014; Winter et al. 2012). Compared to its holistic perspective, there are several reasons for EAM's limited impact: One reason can be found in the scope of EAM, which often is IS-/IT-related and thus does not reach out for those parts of the organization that are not related to IS concerns or IT change projects (Gardner et al. 2012; Ross and Quaadgras 2012). Likewise, the decisions in EAM are traditionally made by a small group of enterprise architects, which limits local impacts of architectural guidance (Aier et al. 2015; Winter 2014). Other reasons may be found in the applied artifacts and coordination mechanisms of EAM: Top-down driven coordination in complex environments and sophisticated artifacts (e.g., meta-models, roadmaps) foster the centralized management of enterprise architectures, its drivers and affected stakeholders, while restricting the design freedom of individual decision-makers (Dietz 2008; Hoogervorst 2004). In all, these limitations of EAM often result in unaligned local and short-term considerations, which at the same time provide the foundation for design decisions in IS change projects. In consequence, EAM-guided change projects, while providing local (business) value, remain limited with regard to their enterprise-wide and long-term contribution.

Although concepts have been introduced that advance EAM by complementary, decentralized (also non-IS-related) perspectives in project guidance (e.g., Winter 2014), the question remains how scholars and practitioners need to consider the impact of EAM on design decisions for enterprise-wide/long-term IS solutions. Hence, the design decisions themselves become the object of analysis. This study is aimed at providing a classification scheme of these design decision for scholars and practitioners, illustrating their differentiating characteristics and dimensions (which we define as the respective classes of characteristics) for further analysis:

RQ: *What are the dimensions and characteristics of design decisions in IS change projects?*

Using the resulting classification scheme in the context of our research, we identify design decision types and discuss how to (re-)consider EAM for better guiding design decisions of the respective decision type for contributing to enterprise-wide/long-term goals.

A.3 Research Design

We used *focus groups* as an instrument for collecting empirical data from practitioners. For this reason, we adopted a structured *design* (section A.3.1), balanced for guided interaction and data collection. Furthermore, we established a feasible *setting* (section A.3.2), having a homogenous group of participants with similar backgrounds and long-time experiences (Krueger and Casey 2000) in order to facilitate the gathered data towards a classification scheme.

A.3.1 Design

The focus group data collection process started as group task with the collection of exemplars of design decisions in IS change projects. Based on their backgrounds and experiences (Krueger and Casey 2000) as well as for better managing discussions, two homogenous groups with four participants each were formed. Both groups had a moderator to guide interactions, to manage time, and to collect data; in this step, the overall objective was to identify and understand all relevant decision dimensions and characteristics based on the previously collected exemplars. Our classification scheme development process was guided by the *method for taxonomy development in information systems* by Nickerson et al. (2013). Taxonomies are a form of classification that employ a *classification scheme* for grouping and categorizing objects (Doty and Glick 1994). The goal is to help both researchers and practitioners to better understand and analyze complex problem domains. Consequently, Nickerson et al.'s (2013) method aims at the schematic classification of objects; hence, we adapt their method for the development of our classification scheme.

In general, Nickerson et al.'s (2013) method starts with a definition of the meta-characteristics (purpose and scope of method application) and ending conditions (expected outcome of method application), followed by a *three-step dimension development process*, and ending up with a revision of the final construct against the earlier stated ending conditions. Regarding the three-step dimension development, Nickerson et al. (2013) propose two alternative approaches: The *empirical-to-conceptual* approach that starts

with a collection of an object subset, on which characteristics will be inductively identified and finally grouped to dimensions. However, we chose to follow the *conceptual-to-empirical* approach and use conceptualization as deductive way of gathering dimensions and their characteristics based on the knowledge and experience (Nickerson et al. 2013) of our focus group members. The following examination of objects for these characteristics and dimensions founded a valid basis for the identification and discussion of design decision types.

A.3.2 Setting

Focus groups are supposed to provide enough time and participants for argumentative diversity on the one side, and not too many participants for ensuring a comfortable atmosphere in sharing thoughts, opinions, beliefs, and experiences on the other side (Onwuegbuzie et al. 2009). Following Kontio et al. (2004) as well as Tremblay et al. (2010b), the ideal focus group is supposed to comprise three to twelve participants, requires between one to three hours, and provides guided discussions by the moderator (Kontio et al. 2004). The focus group was conducted on May 12th 2015 within an established practitioner community. Eight managing enterprise architects, representing six large organizations in the insurance, banking, and logistics industry in Germany and Switzerland, attended the workshop. Each of these managers had authority for decision-making in IS change and development projects; particularly, their project experience and decision responsibilities covered EA, the alignment of business and IT, budgeting, planning, controlling, and reporting.

The participants provided valuable information on decisions in IS change projects: The insurance and financial service industries were of particular interest as these have undergone large regulatory changes in the past years that affected organizations not only in business processes and workflows, but also in the underlying IT infrastructure. Basel III, BCBS 239 (banking) and Solvency II (insurance) are only a few examples that have challenged organizations in the use of IS in both business and IT. The logistics industry complemented our setting, however, by responding with IS change projects mainly to competitive opportunities rather than external forces in the market. Together, the motivations and backgrounds of the attending organizations for pursuing IS change projects diversely enriched our source of focus group data (Rouse 2006; Teece et al. 1997). Hence, we propose that the resulting decision characteristics and dimensions as well as the identifiable decision types are generalizable to also other than the attending organizations and their respective industries.

A.3.3 Procedure

The workshop was initiated by a detailed introduction, which announced the goals for each of the following steps as well as an explanation of the classification scheme development model by Nickerson et al. (2013). As outlined by the single steps of the classification development process (Nickerson et al. 2013), the procedure for the focus group was structured as follows:

Meta-characteristics. The first step was to introduce all participants to the ultimate purpose (meta-characteristics) of this study, including its objects of analysis (design decisions in IS change projects) as well as its construction method (Nickerson et al. 2013). The classification was grounded on the experience and knowledge of the participants solely (see also section A.3.1). For this reason, we conducted an open, non-guided discussion among all participants, taking approximately 30 minutes. The participants were asked to name factual exemplars of design decisions in IS change projects with enterprise-wide and long-term impacts, regardless of the abstraction level. These examples were documented in the order they were named:

"Formulation of architectural principles, online solutions, using SAP HANA, SaaS solution versus own development, cloud usage strategy, definition of "client", IT platforms and infrastructure, RedHat versus Debian, SharePoint versus Confluence, planning of IT budget/investments, ad-hoc solutions in business segments, alignment in targeted architecture (business and IT), project approval business/IT, CUD requirements and applications, central versus decentralized architecture, product structure, sale channels, regulations, vertical range of manufacture, industrialization/digitalization, IT-contract and license management, cross-unit/departmental platforms, Java versus JEE, usage of boundary objects, usage of information and data models, procedure and structure of projects, business rules, key performance indicators, product portfolios, client- versus product-oriented perspectives, security dealings"

Ending conditions. We chose the ending conditions for the construction process on the following basis: All collected objects were supposed to be used for the process of refining the conceptualized results, to be classified, and there had to be at least two illustrative characteristics per final dimension. In order to avoid redundancies and to ensure mutual exclusiveness for each of the dimensions, the refinement process was supposed to end once reaching saturation by conceptualized dimensions that were not further extending/differentiating the classification scheme.

Conceptualize (new) characteristics and dimensions of objects. In this first development step, the participants of both groups directly conceptualized dimensions (without examining actual objects), to which differentiating features (i.e., characteristics) were illustrated in the following. The participants approached this step by first a rather abstract perspective, aligning highly abstract characteristics with each other in order to conceptualize dimensions, then lowering the level of abstraction in order to facilitate illustrative characteristics on a more detailed level. After 45 minutes, all dimensions were conceptualized and all characteristics illustratively enriched.

Examine objects for these characteristics and dimensions. In this step, the participants were asked to examine the conceptualized characteristics and dimensions along the previously collected set of exemplars. This step lasted about 20 minutes in total for both parallel groups. The examination of objects also started from a rather abstract perspective and became, guided by the moderator, more and more detailed over time. In all, only a few specified dimensions had to be refined, some characteristics renamed for a better understanding.

Create (revise) classification. Having conducted the last two steps in parallel, both groups' results were compared in a final discussion slot, which lasted about 20 minutes. In this discussion, the participants were asked to present their results to the other group. Both groups' results were complemented towards the final classification scheme. Using the character of the focus group method, the interaction among the participants facilitated not only the final dimensions, but also their respective characteristics. Similar to the preceding section, this step started from a rather abstract perspective and was developed by the moderator into a more detailed one over time. After approximately 20 minutes, the final ending conditions were met, having two to three characteristics grouped to one dimension, all dimensions being mutually exclusive.

A.4 Results

The final classification scheme (Table 8) responds to our research question with 18 dimensions. For each dimension, we identified two to three illustrative characteristics (Table 8). These characteristics serve as exploratory (however not fully exhaustive) basis for illustrating design decisions in IS change projects. The characteristics follow a certain *scale type*: There are nominal scales, characteristics that can be differentiated, although they cannot be ordered. Furthermore, there are ordinal scales, characteristics that can be ordered but their distance cannot be determined.

Group	Dimension	Illustrative Characteristics			Scale
Decision	Decision properties	Critical/political	Relevant	Not relevant	*Nominal*
	Decision nature	Attractive	Not attractive		*Nominal*
	Decision driver	Collective	Selective	Individual	*Ordinal*
	Decision object	Process	Software	Infrastructure	*Nominal*
	Decision quality	Fact-based	Personal Feeling		*Nominal*
	Level of documentation	Distinct	Partial	Unincisive	*Ordinal*
Decision Process	Decision process maturity	High	Low		*Ordinal*
	Decision-maker competency	Comprehensive	Generalized	Specialized	*Nominal*
	Decision-maker hierarchy	Executive-level	Middle-level	Low-level	*Ordinal*
	Decision-maker locality	Central	Unit-specific	Local	*Ordinal*
	Informality	Low	High		*Ordinal*
	Implementation	Instruction	Guideline	Recommendation	*Nominal*
	Reach of decision	Cross-departmental	Local		*Ordinal*
Decision Impact	Decision bindingness	Mandatory	Partially binding	Open	*Ordinal*
	Range of impact	Enterprise-wide	Organizational unit		*Ordinal*
	Decision-maker allocation	Global	Heterogeneous	Homogenous	*Nominal*
	Impact over time	Unlimited	Limited		*Nominal*
	Acceptance	General	Unequal		*Ordinal*

Table 8: Classification Scheme of Decision Dimensions and Characteristics

Decision. The participants perceived a varying degree of relevance among decision properties, which helped us to understand design decisions by characteristics like critical/political, relevant and not relevant. Similarly, practitioners offered a new perspective on the nature of a design decisions, which was perceived as attractive (prestigious decision) and non-attractive (less relevant, routine decision). The drivers of decisions were

seen as decision-executing stakeholders that can be represented by the collective organization, selected roles, or the individual. Contrary to drivers, the objects of decisions were seen as its targets, whether concerning the infrastructure, the software, or processes. The quality aspects helped us to explore IS change decisions by both subjective and objective associations: While the fact-based character appeared rather objectively evaluable, we learned that the quality is often also a subject to personal feelings and intrinsic motivations (subjectively) of the respective decision-maker. Finally, regarding the coordination character of IS change projects, we learned that not all decisions are supported by formalized mechanisms (distinct documentation), but also maintain less formal (to some degree documented) and informal (unincisive, no/very low level of documentation) ones.

Decision process. Among the reported process-grouped dimensions, which were rather generally discussed beyond specific IS change project associations, we gained insights into the maturity of decision processes. Also more generally discussed was the competency of the decision-maker: Although the focus group members reported several criteria of assessing competence, they admitted in the final in-class discussion that this dimension was perceived, to a major extent, subjectively. Competence was illustrated among comprehensive, an attribute that participants associated with high-level managers and their experience, generalized (associated with project-/line-managers), and specialized (associated with selected individuals). Informality was also discussed beyond specific IS change project associations. In this vein, participants explained localities as centralized (associated with higher influence and competence in decision-making), unit-specific and local (both associated with comparable low influences and competencies in decision-making). Likewise, they explained that hierarchy (of decision-makers) shows different characteristics, such as the executive-level, the middle-level, and the low-level. More project-dependent, we gathered insights into the mechanisms applied in IS change projects: The implementation of decisions may result by instructions (perceived as rather formal), guidelines, or recommendations (both rather informally perceived). Also project-dependent was the reach of the change decision within the firm, which varied between cross-departmental (enterprise-wide) and local (employee-/unit-specific), as stated from the perspective of our focus group participants.

Decision impact. We learned about the effects of IS change projects by the bindingness of decisions: Bindingness was discussed in a range of characteristics like mandatory

(forcing effect), partially binding (guiding effect), and openness (facilitating effect). According to the participants, the impact of decisions can reach out for both IS-related and non IS-related stakeholders, ranging from enterprise-wide (strong, often long-term effects) to unit-specific (local, often specific effects). Regarding the project aspect of IS changes, the allocation of decision-makers helped us to consider decision impacts by the diversity of its concerned decision-makers, being characterized as high (global), partial (heterogeneous) and lowly diversified (homogenous). Additionally, we learned about the time-dimensional aspects of IS changes projects, considering unlimited and limited facets. Finally, we gained insights into the impacts of IS changes by the acceptance of decisions, illustrated by characteristics like general (enterprise-wide agreement) and unequal (mixed agreement).

A.5 Discussion

Based on the developed classification scheme, the next step is set out as identification of design decisions types, and discussion of how EAM needs to be (re-)considered for contributing to the achievement of enterprise-wide and long-term IS solutions. Hence, we use characteristics as differentiating features in order to discuss on which decisions EAM can have an impact, those on which EAM most probably has no impact, and those not being meaningful for this particular differentiation. Using this differentiation, we defined two major types of design decisions: The *hierarchical* one, highly similar to the expected impacts of EAM (see section A.2), and the *lateral* one, grounded on those decision characteristics that are complementary to the hierarchical type. Their key characteristics are briefly stated in Table 9 and illustrated in Table 10.

Hierarchical design decisions	**Lateral design decisions**
Top-down driven coordination mechanisms	Bottom-up consolidation, decentralized
Enterprise-wide/holistic scope	Local perspective, lateral relations
Sophisticated/formal artifacts	Less sophisticated/formalized method support

Table 9: Design Decisions and Key Characteristics

Hierarchical design decisions (Table 10) resemble the mechanisms, scope, and artifacts of traditional EAM as stated by literature (see section A.2). *Lateral design decisions* are

not addressed by traditional forms of EAM: They focus on the middle and lower hierarchical levels, decentralized/local perspectives, and apply less sophisticated methods compared to the hierarchical type. In the following, we discuss the two design decision types and their implications on the use of EAM.

Group	Dimension	Illustrative Characteristics			Scale
Decision	Decision properties	Critical/political	Relevant	Not relevant	*Nominal*
	Decision nature	Attractive		Not attractive	*Nominal*
	Decision driver	Collective	Selective	Individual	*Ordinal*
	Decision object	Process	Software	Infrastructure	*Nominal*
	Decision quality	Fact-based		Personal Feeling	*Nominal*
	Level of documentation	Distinct	Partial	Unincisive	*Ordinal*
Decision Process	Decision process maturity	High		Low	*Ordinal*
	Decision-maker competency	Comprehensive	Generalized	Specialized	*Nominal*
	Decision-maker hierarchy	Executive-level	Middle-level	Low-level	*Ordinal*
	Decision-maker locality	Central	Unit-specific	Local	*Ordinal*
	Informality	Low		High	*Ordinal*
	Implementation	Instruction	Guideline	Recommendation	*Nominal*
	Reach of decision	Cross-departmental		Local	*Ordinal*
Decision Impact	Decision bindingness	Mandatory	Partially binding	Open	*Ordinal*
	Range of impact	Enterprise-wide		Organizational unit	*Ordinal*
	Decision-maker allocation	Global	Heterogeneous	Homogenous	*Nominal*
	Impact over time	Unlimited		Limited	*Nominal*
	Acceptance	General		Unequal	*Ordinal*
	Explanation:	Hierarchical	Lateral	Not differentiating	

Table 10: Differentiated Design Decisions

A.5.1 Hierarchical Design Decisions

In all, we find the hierarchical design decisions as established targets of EAM. Using the classification scheme, we draw a parallel to the traditional EAM literature: On the one side, the *hierarchical* type maintains an enterprise-wide scope (collective drivers, cross-departmental impacts), which resembles the holistic EAM scope as expressed in horizontal and vertical dimensions (Lankhorst 2005; Winter and Fischer 2007). On the other side, this type fosters enterprise-wide perspectives by top-down driven means (e.g., centralized locality, hierarchical-/executive-level, diversified allocation) as associated with traditional EAM coordination mechanisms (Aier 2014a; Aier and Gleichauf 2010). Furthermore, this design is similar to EAM in its underlying management methods, applying for instance instructions and guidelines, and supporting artifacts like characteristics of quality (fact-based), maturity (high), informality (low), bindingness (mandatory), as well as documentation (distinct), which are discussed by traditional EAM literature (Aier et al. 2015; Asfaw et al. 2009; Gardner et al. 2012; Winter 2014). Likewise, the decisions are processed by the organization as a collective rather than by selective or individual drivers.

A.5.2 Lateral Design Decisions

Having reviewed the remaining classification scheme characteristics, one decision type appears not to be targeted by traditional forms of EAM: The *lateral* type. Contrary to top-down driven flows of information, the lateral type appears to be grounded on local, decentralized levels of the organization, for instance among employees (e.g., selective/individual drivers) or specific organizational units (local reach). We found neither a centralized locality nor a global allocation of the decision-maker; contrary, we found low- and middle-level hierarchies as well as unit-specific and decentralized localities. Likewise, reach and impact of decisions remain rather on the local level. Contrary to the top-down structure of the hierarchical type, this decision type draws from less sophisticated support mechanisms (e.g., recommendations) and has no (formal) bindingness. Hence, also the decision methods have a less formalized/hierarchical character (e.g., high informality), expressed for instance by characteristics of decision quality (personal feelings), a low level of documentation (e.g., partial, unincisive) as well as a comparably low maturity.

The identified lateral decision type encouraged us to investigate EAM in decentralized perspectives for considerable impacts on design decisions, including coordination mechanisms and method support (Aier et al. 2015; Proper 2014; Winter 2014). Using the classification data, we explored recent advancements in literature that promote the thinking in enterprise-wide/long-term perspectives, favoring to internalize these perspectives in decisions across organizational hierarchy levels, not restricted to IS-/IT-related stakeholders (Ross and Quaadgras 2012). Considering the classification data through these concepts, the lateral type appears capable for being targeted by EAM, achieving enterprise-wide impacts on local, decentralized levels (Aier et al. 2015; Lattanze 2012; Winter 2014): For example, the proposed sophisticated character of methods can be complemented by a "lightweight" (e.g., principle catalogue, charts) method support (Winter 2014), which fits the lateral design decision as discovered in the classification scheme.

A.5.3 Implications on the Impact of EAM

Achieving enterprise-wide and long-term solutions in IS change projects was shown to be compromised by EAM's limited reach and impact on design decisions. In all, we can suggest two options for achieving these enterprise-wide/long-term considerations: The first one is to guide IS change projects by targeting only those design decisions that follow a hierarchical, sophisticated character, which is expected to strengthen the impact of traditional EAM on IS change decisions.

The second option is to guide IS change projects by reconsidering traditional EAM through complementary coordination mechanisms. Similar to the *lateral* type, this option favors the inclusion of local, decentralized perspectives and the extension of EAM towards non-IS-related stakeholders (Abrams et al. 2006; Aier et al. 2015; Dietz 2008). Furthermore, enterprise-wide goals will have to be aligned with the local levels of the organization in order to bridge conflicting goal systems and to strengthen enterprise-wide, holistic considerations (Aier et al. 2015). While traditional EAM approaches focus rather sophisticated support artifacts (Aier et al. 2015; Winter 2014), the inclusion of decentralized perspectives will require decisions to follow non-hierarchical and less formalized methods (Lattanze 2012; Ross and Quaadgras 2012; Winter 2014). In sum, it will aim at educating individual decision-makers to internalize enterprise-wide/long-term considerations of the organizational IS landscape (Aier et al. 2015), thereby incorporating also non-IT-/IS-related stakeholders (Gardner et al. 2012; Ross and Quaadgras 2012) for guiding IS change projects.

To this end, the classification scheme illustrates several dimensions that remain not meaningful for differentiating design decisions into EAM-impacted and not-impacted ones, which propose an avenue for future research. For example, there are *properties* and the *nature* of decision: To the best of our knowledge, neither of these types has received an in-depth exploration by EAM literature yet. This also infers the assumption that some dimensions/characteristics are rather general attributes that are not specifically connected to the IS/IT change (project) context. Nevertheless, the participants of our focus groups discussed critical properties and attractive natures as highly relevant factors for motivating the participation in IS changes. Similar is the *object* of the decision as well as the *competency* of the decision-maker, which may shift the perspective of future research onto more environment-dependent design decision analyses; environments may change and thus will require a context-specific understanding of design decisions. Finally, the dimensions *time* and *acceptance* are important impact factors on EAM that may or may not differentiate EAM's effects from a longitudinal perspective. Based on the literature at hand, we were not able of drawing conclusions on EAM successfulness with regards to time series. However, we expect that the analysis of design decisions in IS change projects is and will receive ongoing attention as a central element for achieving consistent IS solutions with enterprise-wide and long-term considerations.

A.6 Conclusion

This study provides concrete insights into design decisions of IS change projects. We contribute to the understanding of guiding IS change projects by the means of EAM with illustrative exemplars of decision characteristics and dimensions that go beyond the theoretical discussions provided by literature so far. Drawing from the developed classification scheme, a large number of characteristics was meaningful for identifying types of design decisions and hence, for discussing how to achieve enterprise-wide and long-term considerations in IS change decisions by the means of EAM, following traditional and complementary perspectives, respectively. However, this study also maintains some limitations: Based on the homogeneity of the focus group, the developed classification scheme represents only a selective set out of a potentially large number of decision characteristics in IS change projects. A concrete use case would strengthen the findings to this point. Future research might also use our results as a basis for further generalizability and substantiate of the pool of identifiable design decision types.

Paper B – Themes of Coordination in IS Reference Theories

Title	Themes of Coordination in IS Reference Theories
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Abstract

Due to ever-growing investments in information systems (IS) in organizations, IS literature promotes an enterprise-wide perspective to keep local, short-term investments in line with global, long-term intentions. One of the central discourses in realizing an enterprise-wide perspective is the necessity of coordinating IS change and development efforts across organizational units. Notwithstanding its criticality, there is a lack of coherent body of theory about coordination. This study hence seeks to spotlight coordination as a lens by investigating prominently used reference theories in IS that implicitly consider coordination. Through conducting thematic analysis and synthesizing the reflection of coordination in IS reference theories, this study identifies four theory-grounded themes of coordination namely, informing, controlling, legitimating, and socializing. The identified themes guide prospective research in investigating IS phenomena through the lens of coordination.

Keywords

Coordination, Reference Theory, Thematic Analysis, Theme

B.1 Introduction

Over the past decades, we have witnessed an enormous growth of investments in information systems (IS) in organizations. Even though these constant investments have had a considerable impact on organizations' performance (Brynjolfsson and Hitt 2000; Melville et al. 2004), they caused ever-growing challenges in *coordinating IS change and development* projects, which are distributed across business units (Peterson 2004). All of today's large organizations have to deal with a significant number of IS projects—affecting several hundred to some thousand applications—of which budgets and ownerships are often allocated to business units. Investments in IS thus tend to be developed to meet the short-term, local units' business needs without the consideration of a long-term, *enterprise-wide* prospect (Boh and Yellin 2006).

There are a number of disciplines in practice as well as in IS literature that address the issue of coordinating IS changes and developments so as to commit an enterprise-wide perspective, and to ensure the consistency of IS investments with long-term intentions. More prominently, the fields of IS governance (Peterson 2004; Sambamurthy and Zmud 1999), enterprise architecture (Boh and Yellin 2006; Schmidt and Buxmann 2011; Zachman 1987), and IS project portfolio management (Bardhan and Sougstad 2004; De Reyck et al. 2005), among others, contribute to this discourse. Through taking a concerted view on IS investments, these disciplines share the same concern, that is, to coordinate change and development endeavours throughout an organization. While not focusing on a specific discipline of discourse, this study employs an orthogonal perspective on coordination itself as it is central to realizing an enterprise-wide view and is one of the pivotal discussions in the pertinent disciplines. To this end, we focus on *coordination as a lens*, and aim to identify and eventually synthesize theoretical bases to be used in the investigation of enterprise-wide endeavours.

Coordination is defined as "integrating or linking together different parts of an organization to accomplish a collective set of tasks" (Van de Ven et al. 1976) and as "the act of managing interdependencies between activities performed to achieve a goal" (Malone and Crowston 1990). With regard to theoretical bases, there is no single coherent body of theory about coordination (Malone and Crowston 1990). Although Malone and Crowston (1990) provide relevant conceptualizations for a theory on coordination, their contribution did not enjoy a wide uptake in the literature, and was reflected and employed in only a few studies such as (Crowston 1997; DeSanctis and Jackson 1994). Building on Malone and Crowston (1990)'s contribution, we argue that there are theories from many different disciplines that implicitly consider coordination, and can consequently

be used in our effort to formulate coordination as a theoretical lens. To cater a theory-grounded synthesis on coordination and due to interdisciplinary nature of coordination (Malone and Crowston 1994), this study investigates *IS reference theories* that implicitly cover coordination. IS reference theories refer to imported, borrowed theories (e.g., institutional theory, game theory) from external disciplines (e.g., management science, computer science, sociology) to describe, explain, predict, or design IS phenomena (Straub 2012).

This study employs a thematic analysis approach in investigating coordination in IS reference theories. Based on existing conceptualizations on coordination, we develop an analysis framework at the outset. We use this framework to examine how, and from which perspectives, IS reference theories consider coordination. This research process results in identifying *four themes of coordination* namely, *informing*, *controlling*, *legitimating*, and *socializing* and their complementarity. These themes can be used in different IS disciplines to guide prospective research on enterprise-wide endeavours through a coordination lens. Since our investigation is built on IS reference theories, the derived themes can also contribute to coordination-related discourses in the reference disciplines.

The remainder of this paper is structured as follows: First, we introduce the methodology of this study, explaining how IS reference theories are collected and investigated by a systematic and deductive research process. We then identify coordination approaches in IS reference theories, and thematically synthesize them to the four themes of coordination. Implications and limitations are finally discussed.

B.2 Methodology

In the investigation of coordination as a lens for studying IS phenomena, we examined dominantly used IS reference theories. To investigate how IS reference theories approach coordination, to classify and eventually synthesize them into themes of coordination, we opted for a thematic analysis approach (Boyatzis 1998) along with adapting Nickerson et al.'s (2013) taxonomy development method to the purpose of our research (Figure 8). A theme refers to a manifestation of latent patterns within the given set of qualitative data (Boyatzis 1998). First, based on extant discussions on coordination, we developed an analysis framework to not only outline the underpinning concept of coordination, but also to systematically analyse implicit reflections of coordination in IS reference theories. We then collected IS reference theories according to their relevance

to the formerly developed framework. We finally conducted a thematic analysis to identify themes of coordination from IS reference theories.

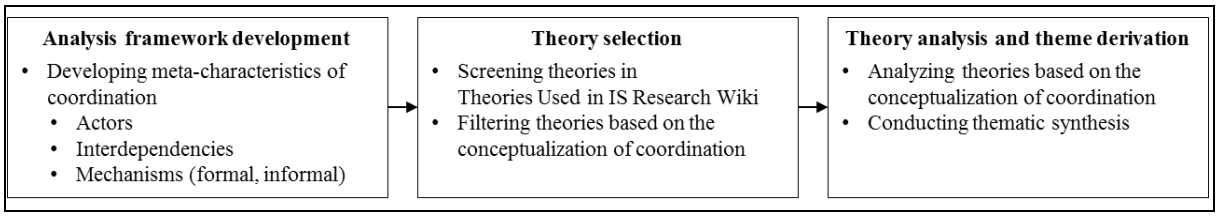

Figure 8: Research Process

Analysis framework development: Following Nickerson et al. (2013), at the outset we derived meta-characteristics underlying the concept of coordination (Table 12). According to the most dominant definitions, coordination refers to "integrating or linking together different parts of an organization to accomplish a collective set of tasks" (Van de Ven et al. 1976), and to "the act of managing interdependencies between activities performed to achieve a goal" (Malone and Crowston 1990). Building on these definitions, we derived three meta-characteristics of coordination concept namely, *actors*, *interdependencies*, as well as *mechanisms*. In effect, actors in an organization perform tasks, and interdependencies determine how to perform these tasks (Malone and Crowston 1990). These interdependencies are due to common goals among different actors, collective set of activities to achieve goals, as well as shared resources that are used or affected by activities (Crowston 1994). As such, coordination issues arise when interdependencies constrain actors for performing activities, achieving goals, or using resources (Crowston 1994). To manage interdependencies, and eventually to deal with coordination problems, existing literature promotes formal hierarchical structures and informal lateral relations, which are called coordination mechanisms by Martinez and Jarillo (1989).

Regarding *actors*, we took into account different levels of analysis due to distinctive focus of the examined theories. Actors were considered in "individual" (e.g., employee, decision-maker), "group" (expressed in terms like collectives, social systems, or networks), and "organization" (comprising multiple groups) levels (Malone and Crowston 1990). "Market" and "society" were additionally added as the scope of some theories reaches beyond individuals and organizations, and therefore raises the level of abstraction (Giddens 1984). We characterized "market" beyond the organizational level, dealing with dependencies or relations among organizations, or formalized structures. Far beyond the perspective of market is what we characterized as "society", a term for multiple structures or social systems.

Regarding *interdependencies*, Malone and Crowston (1990) as well as Crowston (1994) characterized "activities", "resources", and "goals" as determinants of interdependencies among actors. "Goal" is defined as ends, expectations, or directions, to which activities are performed (Crowston 1994) . "Activity" is a representation of pursuing something, described by workflows, processes, routines, or control practices (Malone and Crowston 1990). "Resource" is represented by a vast range of physical (e.g., work assets) and abstract (e.g., information, capability) objects (Crowston 1994).

Mechanisms built on Martinez and Jarillo's (1989) conceptual framework on coordination mechanisms, comprising both *formal* and *informal* dimensions. Their framework was chosen in favour of other conceptualizations on coordination mechanisms (Brown 1999; DeSanctis and Jackson 1994; Galbraith 1973; Grant 1996; Mintzberg 1979; Okhuysen and Bechky 2009) due to the level of abstraction and comprehensiveness, being applicable to all characterized actors and interdependencies. Following Martinez and Jarillo (1989), we characterized *formal mechanisms* as "departmentalization", a mechanism that deals with the structural design of the organization (e.g., units), "decision-making", which describes hierarchically-fostered forms of authority command, "formalization and standardization", which describes the extent to which rules or job descriptions are written down (e.g., manuals, documents), as well as "planning" (e.g., strategies, functional plans) and "control" (e.g., of behaviour, output) mechanisms. Following Martinez and Jarillo (1989), we also characterized *informal mechanisms* comprising "lateral relations", describing direct contacts among individuals complementarily to hierarchy, "communication", describing informal contact among individuals, as well as "socialization", illustrating cultural- and emotional-oriented mechanisms among actors (e.g., shared goals).

Actors					Inter-dependencies			Mechanisms							
								Formal					Informal		
Individual	Group	Organization	Market	Society	Activity	Resource	Goal	Departmentalization	(De-)Centralized Decision-Making	Formalization/ Standardization	Planning	Output/Behaviour Control	Lateral relations	Informal Communication	Socialization

Table 12: Analysis Framework (adapted from Crowston 1994; Malone and Crowston 1990; Martinez and Jarillo 1989; Van de Ven et al. 1976)

Theory selection: Theories were retrieved from the *Theories Used in IS Research Wiki* (Larsen et al. 2015). The provided list of theories is contributed by researchers from the international IS community, and has been acknowledged as scholarly information and explanatory source (Lim et al. 2009; Straub 2012). Due to the large number of theories available, the next step set out an iterative theory screening and filtering process. Based on our outlined conceptualization of coordination, we systematically selected theories in two sequentially filtering rounds: First, coordination had to be illustrated as an interdependency, involving actors that are dependent on goals, activities, or resources. Second, there had to be mechanisms for coping with these interdependencies. Starting with 91 theories, we finally selected 16 reference theories complying with our outlined conceptualization. In order to ensure covering all aspects of theories on coordination, and to exclude interpretations or interferences that could have biased the original lenses, we traced all theories back to their seminal developments. To reach out seminal developments solely, we looked up all listed references per theory in *Theories Used in IS Research Wiki* through Google Scholar, and selected the two highest-cited seminal references for each reference theory. Due to the elapse of time since the seminal contributions, and for a better understanding of the more prevalent theory aspects as well as discourses, we additionally selected two articles from IS literature (provided in Theories Used in IS Research Wiki) that applied the respective theories (Larsen et al. 2015). The latter includes both the most recent published paper as well as the highest-cited papers in the AIS senior scholars' basket of journals.

Theory analysis and theme derivation: In order to examine how IS reference theories consider coordination, we applied our outlined conceptualization, and coded all theories by their respective illustration of actors, interdependencies, and mechanisms. Including each theory's assumptions, we described the original context of analysis, and particularly those elements that reason coordination in the given assumptions of each theory. As such, guided by our analysis framework, which contains all previously defined meta-characteristics and their constitutive elements, we finally derived the main themes of coordination in IS reference theories.

B.3 Coordination in IS Reference Theories

Coding of theories based on our analysis framework aimed to identify how coordination is implicitly reflected in each respective IS reference theory. To this end, we derived underlying assumption of each theory, which helped us understand the background of

pertinent actors, interdependencies, and mechanisms, and that further reasoned coordination for the given assumption. Table 13 summarizes the main assumptions of the selected theories along with their approach to coordination with regard to our analysis framework.

Agency Theory	• Assumption: Work performed by division of labour and contracted principal-agent relations; economic uncertainty; asymmetric information; conflicting risk-behaviour/goal settings between principals and agents • Actors: Individual, group, organization • Interdependencies: Informational and behavioural interdependencies (involving goals and activities) • Mechanisms: Practices of risk and behaviour control' (hierarchical) forms of decision-making; formalization (e.g., allocation of property rights)
Seminal articles:	*(Alchian and Demsetz 1972; Jensen and Meckling 1976)*
IS references:	*(Chen and Edgington 2005; Melville et al. 2004)*
Boundary Objects Theory	• Assumption: Communities of practice (e.g., teams with shared characteristics, common language) with interacting and communicating relations; need for mutual understanding and common "language basis" across communities • Actors: Individual, group, organization (collectives related to "community of practice") • Interdependencies: Dependency on shared area of concern (e.g., goal, activity) as a basis for mutual understanding • Mechanisms: Diverse formal (e.g., formalization) and informal (e.g., communication) instruments for creating common understanding and shared knowledge communities
Seminal articles:	*(Bowker and Star 2000; Star and Griesemer 1989)*
IS references:	*(Levina and Vaast 2005; Rosenkranz et al. 2014)*
Game Theory	• Assumption: Formalized incentive structure (i.e., "game"); two or more parties involved; rational decision-making by anticipation of and reaction to actions of other involved parties (e.g. for benefit maximization) • Actors: Individual, group, organization; "formalized structures" (e.g., also market and society) • Interdependencies: Dependency on the respective activities and goals of others

	• Mechanisms: Decisions-making and behaviour control; modelling and planning among alternatives affecting the respectively involved other parties (un-/informed)
Seminal articles:	*(Nash 1950; Von Neumann and Morgenstern 1944)*
IS references:	*(Clemons and Row 1993; Gal-Or and Ghose 2005)*
Institutional Theory	• Assumption: Organizations as social constructions; isomorphism fostered by cultural-cognitive, normative, and regulative mechanisms; constraining and regulating organizational behaviour • Actors: Organization, market, society • Interdependencies: Dependency of social constructions on their and others' activities, and resources • Mechanisms: Regulative, normative, and cultural-cognitive mechanisms for regulating and controlling behaviour; socialization
Seminal articles:	*(DiMaggio and Powell 1983; Scott 2013)*
IS references:	*(Bharati and Chaudhury 2012; Orlikowski and Robey 1991)*
Organizational Culture Theory	• Assumption: Organizations as cultural processing system (functional view); cultural patterns in organizations, and their adoption by individuals as legitimate way for perceiving, thinking, and (un-/conscious) feeling within the cultural system • Actors: Individual, group, organization • Interdependencies: Integration of individuals; behaviour of individuals consciously and unconsciously dependent on cultural (processed) patterns • Mechanisms: Cultural patterns processed through espoused values (e.g., strategies, goals), visible artefacts (e.g., formalized/structural mechanisms), and underlying assumptions (e.g., informal mechanisms), yielding internal integration/external adaptation
Seminal articles:	*(Burrell and Morgan 1979; Schein 2010)*
IS references:	*(Iivari and Huisman 2007; Leidner and Kayworth 2006)*
Organizational Information Processing Theory	• Assumption: Amount of information processed determined by uncertainty; labour division and specialization, requiring integration of interdependent roles and tasks, as well as the increase of information processing capabilities • Actors: Organization

	• Interdependencies: Organization design; interdependent roles and tasks • Mechanisms: Integrating mechanisms, such as rules or programs, hierarchy, targets, and goals; design strategies, such as the creation of slack resources, self-contained tasks, vertical information systems, and lateral relations
Seminal articles:	*(Galbraith 1973; 1974)*
IS references:	*(Gattiker and Goodhue 2005; Trkman et al. 2010)*
Organizational Knowledge Creation Theory	• Assumption: Static forms of knowledge (i.e., tacit, explicit) in the organization (per se not sufficient for creating organizational knowledge); dynamic knowledge conversion creating organizational knowledge • Actors: Individual, group, organization • Interdependencies: Organizational knowledge dependent on information conversion patterns • Mechanisms: Four dynamic patterns of knowledge creation by information conversion/ exchange mechanisms: Internalization, externalization, combination, and socialization
Seminal articles:	*(Anderson 1983; Nonaka 1994)*
IS references:	*(Lee and Choi 2003; Ruiz-Mercader et al. 2006)*
Organizational Learning Theory	• Assumption: Stored/embedded information (e.g., memory, routines); applicable for reflecting undertaken actions between expected and factual outcomes; necessary due to changing goals and/or environments • Actors: Individual, group, organization • Interdependencies: Dependency on information resources and decision-making activities • Mechanisms: Informal/lateral relations for information adaptation and interpretation; application of information in decision-making for organizational learning
Seminal articles:	*(Huber 1991; Levitt and March 1988)*
IS references:	*(Hahn et al. 2009; Salaway 1987)*
Resource Dependency Theory	• Assumption: Uncertainty in resource acquisition; control over resources fostering interdependencies among organizations to maintain and drive competitiveness • Actors: Organization, market • Interdependencies: Dependency on resources and control-related activities

	• Mechanisms: Bargaining power of control over resources; lateral and social firm relations among (interdependent) organizations
Seminal articles:	*(Pfeffer 1981; Pfeffer and Salancik 2003)*
IS references:	*(Lee and Kim 1999; Yeh 2005)*
Social Capital Theory	• Assumption: Organizations as value-maintaining systems of social relationships (e.g., relations among actors); formation of social capital through individual human capital • Actors: Individual, group, organization (collective formations) • Interdependencies: Dependency on the value of relationships to others (resources, goals, activities) • Mechanisms: Mechanisms in relationships (e.g., lateral relations, socialization); mechanisms in management of collectively owned capital (e.g., socialization, communication)
Seminal articles:	*(Coleman 1988; Granovetter 1973)*
IS references:	*(Wasko and Faraj 2005; Yuan et al. 2006)*
Social Cognitive Theory	• Assumption: Inter-personal relations and (social) behaviour of individuals; actor analysing through embedded information (e.g., in behaviour), observation, and interpretation • Actors: Individual, group (collective formations) • Interdependencies: Dependency on activities and goals of others' behaviour • Mechanisms: Socialization and lateral relations among individuals (fostering cognition, adoption and interpretation of others' behaviour)
Seminal articles:	*(Bandura 1977; 1986)*
IS references:	*(Compeau et al. 1999; Liaw et al. 2006)*
Social Network Theory	• Assumption: Social relations among individuals (see also Social Capital Theory); inter-personal connections for information/knowledge diffusion • Actors: Individual, group, organization (collective formations) • Interdependencies: Dependency on the relationship to others (e.g., on their activities, resources, goals) • Mechanisms: Mechanisms in relationships and exchange practices (e.g., lateral relations, communication, socialization)
Seminal articles:	*(Granovetter 1973; Watts and Strogatz 1998)*
IS references:	*(Wade et al. 2006a; 2006b)*

Stakeholder Theory	• Assumption: Stakeholders with legitimate interests on the organization; stakeholder identification, analysis, and management necessary for organizational value creation • Actors: Individual, group, organization, market, society (stakeholder formations) • Interdependencies: Organization dependent on (the legitimate interests of) its stakeholders (involving their activities, resources, goals) • Mechanisms: Stakeholders management and analysis excelled by formalization and planning mechanisms
Seminal articles:	*(Donaldson and Preston 1995; Freeman 1984)*
IS references:	*(Chan and Pan 2008; Smith and Hasnas 1999)*
Structuration Theory	• Assumption: Society's structures impacted/formed by the interactions of individuals, in turn, society's structures impact these interactions of individuals (i.e., "interplay") • Actors: Individual, group, organization, market, society (structure formations) • Interdependencies: Dependency on structures as well as interplay among individuals and structures (involving activities, resources, goals) • Mechanisms: Formal shape of structures imposed by individuals (e.g., through behaviour, habits, routines); structures impacting the interactions of individuals
Seminal articles:	*(Giddens 1984; Giddens 2013)*
IS references:	*(Orlikowski 1996; Pozzebon and Pinsonneault 2005)*
Theory of Administrative Behaviour	• Assumption: Limited information available to decision-maker in organizations; decision options and impacts often partially or completely unknown; bounded rationality of decision-maker that are governed by the structural design of the organization • Actors: Individual, organization • Interdependencies: Decisions are dependent on organizational design (e.g., activities, resources, goals) • Mechanisms: Rationale design activities of the decision-maker's organizational environment, such as by structural mechanisms; formalization, and the allocation of decision-making authority (i.e., decentralized mechanisms)
Seminal articles:	*(March and Simon 1958; Simon 1955)*
IS references:	*(Bakos and Treacy 1986; Lamb and Kling 2003)*

Theory of Collective Action	• Assumption: Expectations towards certain achievements by individual actors; collective (e.g., in teams, groups, unions) pursuing of interests for effectively achieving individually-shared goals and/or achievement expectations • Actors: Individual, group, organization (collective formations) • Interdependencies: Dependency on (expected/shared) collective goals, resources, and activities • Mechanisms: Interest alignments by individually-shared goals (e.g., lateral relations, socialization); management of group size to effectively and efficiently pursue collective actions (formal decision-making and control mechanisms)
Seminal articles:	*(Hardin 1982; Olson 1965)*
IS references:	*(Wasko et al. 2004; Zhao et al. 2011)*

Table 13: Coordination in IS Reference Theories

B.4 Themes of Coordination

Our investigation of IS reference theories has identified various coordination mechanisms through which interdependencies among different actors are managed or set up. In general, theories are about actors, as well as interdependencies among actors due to shared activities, goals, and/or resources. Corresponding to our outlined conceptualization, coordination mechanisms not only help further explore interdependencies, but also shed light on how to cope with them. As such, coordination mechanisms underlie interdependencies, do impact them, and are imposed as well as upheld by them. We now elaborate on these findings that guide us synthesizing themes of coordination.

(1) We found one prevailing element of coordination that exists in exchange and alignment practices among individuals, groups, and organizations: Information. In all contexts and under various theoretical assumptions, an integral part of any interdependency among actors as well as any coordination mechanism was information, which was embedded throughout the organization, and occurred in both explicit and implicit forms (Anderson 1983; Nonaka 1994). Although actors were apparently impacted by information, information itself necessarily required actors to enable and facilitate it (dynamic interactions), for instance towards specific activities, goals, or under certain situations (e.g., Levitt and March 1988). Information is both formalized and subtle; it could be both actively transmitted in explicit nature (e.g., for achieving a basis for shared understanding, see Star and Griesemer 1989), and implicitly gathered, for instance embedded in objects (e.g., routines) or actors (Bandura 1977). Often, information created

an essential understanding of where particular problem settings or conflicting misalignments among actors and/or their interdependencies are.

(2) Especially among the set of theories originated from sociology (e.g., social capital theory, social network theory), we found a wide range of lenses that are, although grounded in different contexts and share different assumptions, oriented towards the relations of individuals. We found a vast part of actor-related (mostly individual-relying) interdependencies that were particularly fostered by the behaviour and the perceptions of actors. Actors appeared to enable coordination by their social relations towards other actors (Granovetter 1973): They observe human behaviour, adopt, and interpret information or anticipate (re-)actions in social relations (Levitt and March 1988). Socialization created a more concrete understanding where hierarchical coordination reaches its limit, and where lateral coordination complemented interdependencies among involved actors. It furthermore drew attention on coordination from an individual perspective in a particular situation, context, or interdependency (e.g., towards collective goals) (Olson 1965).

(3) In contrast to these individual-oriented, lateral perspectives of coordination, we found a large number of theoretical assumptions that expose interdependencies impacted by often centralized forms of coordination. These characteristics of coordination were particularly categorized by our analysis framework as control. Controlling helped us cater a solid understanding of coordination that aims to solve potential conflicts among interdependent actors. Often, behavioural aspects of an actor represented a conflict assumption to the organizational level, and, based on these assumptions, coordination evolved for moderating expected negative effects (Alchian and Demsetz 1972). Furthermore, it can evolve between the organizational and individual level for harmonizing not collectively shared goals (e.g., Schein 2010).

(4) Based on our set of theories, we further captured a particular mode of coordination, which resembled an embedding system for actors, interdependencies, and mechanisms. This embedding system, for instance, encompassed a social (Scott 2013) or cultural construction (Schein 2010). This finding, which enjoys a considerable support from IS reference theories, referred to coordination with the purpose of harmonizing interdependencies among actors by a wide range of, for instance, cultural, normative, dynamic, or environmental mechanisms (DiMaggio and Powell 1983; Giddens 1984; Schein 2010). What these forms of coordination had in common was the purpose of gaining and providing legitimacy within their respective system environment. This legitimacy

helped us understand both single, situational dynamics as well as cumulative (e.g., cultural) systems in their entirety (Giddens 1984), therefore reasoning coordination generally beyond selected actors, interdependencies, or situations.

Building upon the abovementioned insights, we outline four themes of coordination: *(1)* Informing, *(2)* socializing, *(3)* controlling, and *(4)* legitimating (Table 14). For each of these themes, we describe common purposes and provided illustrative examples of these purposes.

Theme	Purposes of coordination: *Illustrative example*
Informing	• Information exchange: *Information acquisition and application in decision-making processes (e.g., Levitt and March 1988)* • Dynamic information facilitation: *Interaction for knowledge creation and facilitation throughout the organization (e.g., Nonaka 1994)* • Bridging dissimilar/asymmetric levels of information: *Achieving a basis for common understanding (e.g., Star and Griesemer 1989)*
Socializing	• Achieving collective benefits: *Social networks upheld for collectively-shared goals (e.g., Olson 1965)* • Achieving social relations: *Social integration by the formation of networks (e.g., Granovetter 1973)*
Controlling	• Mitigating expected negative effects resulting from not collectively shared goals: *Contract between principal and agent against negatively expected effects through the agent's behaviour (e.g., Jensen and Meckling 1976)* • Harmonizing not collectively shared goals: *Values and norms established towards desired conceptions, by which behaviours can be compared (e.g., DiMaggio and Powell 1983)*
Legitimating	• Harmonization by cultural and normative patterns: *Taken-for-granted character of culture among all those who follow, adapt, or change it (e.g., Schein 2010)* • Harmonization by dynamic patterns: *Interplay among actors changing structures, and the structures changing the interactions of actors (e.g., Giddens 1984)* • Harmonization by environmental factors: *Organizations becoming legitimized systems by producing social behaviour, and being reproduced by this behaviour (e.g., DiMaggio and Powell 1983)*

Table 14: Purposes and Illustrative Examples of Coordination Themes

B.4.1 Informing Theme of Coordination

The informing theme of coordination exists among multiple exchange practices and interrelations dealing with explicit or implicit forms of information (and knowledge). One purpose of coordination in this theme is *information exchange*. Organizational learning theory for example shows coordination as an instrument for knowledge acquisition, interpretation, and application (e.g., in decision-making processes) (Levitt and March 1988). The bulk of information gathered from any object may be adapted and used for pursuing different goals and activities (Freeman 1984; Granovetter 1973; Nahapiet and Ghosal 1998), for interpreting as well as changing goals and activities (Huber 1991), or for being implicitly shared by individual behaviour (Nonaka 1994; Schein 2010; Scott 2013).

We also find coordination more dynamically represented among exchange practices, for example in organizational knowledge creation. We define this coordination purpose as *dynamic information facilitation*. We know from theory that knowledge itself is distinct (i.e., is tacit in nature), and requires continuous interaction activities as well as information processing capabilities for facilitating knowledge in larger environments (e.g., in organizations) (Galbraith 1973; Nonaka 1994). Within an organization, the more information is shared, the more interaction there is, and the more information is facilitated throughout the organization (Nonaka 1991).

Furthermore, we find a purpose of coordination that deals explicitly with *bridging dissimilar or asymmetric levels of information*: For example, boundary objects act as mechanisms for externalizing and combining distinct and/or asymmetric levels of knowledge, information, and understandings within or also among groups of individuals (Bowker and Star 2000; Star and Griesemer 1989).

B.4.2 Socializing Theme of Coordination

A prevalent theme of coordination among the investigated theories is socialization, which is to the major extent determined by interdependencies that take place within social relations and interrelations among individuals. One purpose of coordination can be described as *achieving collective benefits*. In social capital theory for example, coordination can be perceived as a means for aligning social relations for collective benefits (Coleman 1988; Nahapiet and Ghosal 1998). Hereby, coordination can be interpreted as relational instrument enabled among individuals or groups, and it can further be determined by shared goals, resources, and activities in selected situations (Nahapiet and Ghosal 1998). The theory of collective action also promotes social interrelations among

individuals for achieving shared goals among the involved actors (Hardin 1982; Olson 1965).

Coordination also deals with the purpose of *achieving social relations*. For example, socialization occurs in processes of personal contact and social integration among individuals and groups (e.g., Granovetter 1973). Given the focus on personal contacts and social integration, we find social relations laterally aligning and tying individuals in networks, for instance for the purpose of information and knowledge exchange (Granovetter 1973; Nahapiet and Ghosal 1998). Following social cognitive theory, socialization achieves social relations particularly in lateral structures, where individuals observe the behaviour/interaction of other individuals, and adopt it to their actions and behaviour, ultimately reproducing social structures in their environment (Bandura 1977).

B.4.3 Controlling Theme of Coordination

Another widely used theme of coordination is concerned with control. Here, we find coordination as an instrument for the purpose of *mitigating expected negative effects resulting from not collectively shared goals*. Goals exist on the organization-wide level; however, organization-wide goals may not necessarily be shared by all actors. For example, agency theory perceives coordination as instrument for solving conflicts that may arise due to the potentially conflicting behaviour of an individual under asymmetric distributed information and/or capabilities (Jensen and Meckling 1976). As illustrated by agency theory, the unequally expected gains and losses from interdependencies between individual and organizational goals are necessarily required to be controlled by coordination (Alchian and Demsetz 1972). A similar argumentation is provided by resource dependency theory, revealing control as mechanism for mitigating expected negative effects resulting from not possessed resources (Pfeffer and Salancik 2003). Although resource dependency theory is primarily concerned with the inter-organizational level, the control of resources for coordination does well apply to the intra-organizational level, too. Similarly, game theory is concerned with the mathematical modelling of decision-making among two involved parties that face potentially resulting costs and losses through the decision of the respective other party involved (Von Neumann and Morgenstern 1944): The theory assumes that all involved players think rationally and analyse the structure in order to coordinate their actions (decisions) to their own goals and benefits.

Furthermore, coordination maintains a purpose of *harmonizing not collectively shared goals*. This purpose supports coordination as a control instrument on both the organizational and inter-organizational levels. Following the inter-organizational perspective discussed by Scott (2013), the social construction of institutions is built on a set of regulative, normative, and cultural-cognitive mechanisms (DiMaggio and Powell 1983; Scott 2013): The regulative pillar concerns a set of coercive mechanisms through which organizations constrain and regularize behaviour. The cultural-cognitive pillar creates the frames through which shared conceptions are made. Finally, the normative pillar introduces an obligatory dimension into social life by the means of values and norms; while values are the desired conceptions to which existing behaviours can be compared, norms are legitimate means to pursue valued ends (DiMaggio and Powell 1983). We take this argument as bridge from the inter-organizational to the organizational perspective. Following organizational culture theory, not collectively shared goals become harmonized in the process of internal integration by cultural patterns, which are processed on both the conscious and unconscious level (Schein 2010). While on the conscious level, organizations become visible in their artefacts (e.g., structures, processes) and espoused values (e.g., goals, strategies), the unconscious level remains with underlying assumptions (e.g., perceptions, thoughts, feelings), through which culture (e.g., goals as part of espoused values) becomes ultimately adopted and followed by individuals (Schein 2010).

B.4.4 Legitimating Theme of Coordination

The legitimacy theme explains coordination as a taken-for-granted character. One purpose of coordination in legitimacy is the *harmonization* of (sub-) systems (e.g., business units) with their overall environments (e.g., organizations) *by cultural and normative patterns*. Following organizational culture theory, we can identify taken-for-granted characteristics among cultural mechanisms, which are used for driving internal integration and organizational behaviour beyond selected actors, interdependencies, or situations. Often, organizational culture is favoured as a static legitimating process. Culture exists by certain norms, values, and rules, which are adapted by organizational actors; the subsequent perception and behaviour of actors are a result of the perceived culture (Schein 2010).

We further find a coordination purpose for the *harmonization by dynamic patterns*. Once again, organizational culture serves as an illustrative example. Culture exists as a dy-

namic legitimating process: Norms, values, and other cultural mechanisms can be actively influenced (e.g., by activities), and therefore vary in organizations and situational contingencies. For instance, an organization can have sub-cultures (Schein 2010). In this case, coordination becomes a legitimating means, as it represents a cultural taken-for-granted character among all those who follow, adapt, or those who change it. Another example is the dynamic interplay among individuals and the structure they are acting in (Giddens 1984). Structures are created through the actions of individuals (or assumptions on them, see Jensen and Meckling 1976), organized as rules, or social systems. Structures reproduce the actions they are impacted by, and that simultaneously impact the actions of individuals ("interplay"), which we identify as dynamic form of harmonization (Giddens 1984). Consequently, individuals start to rationalize their activities, resource usage, and goals based on these structures (Giddens 1984).

Another purpose of coordination is the *harmonization by environmental factors*. According to institutional theory, organizations become legitimated social constructions, where they provide stability and meaning to social life (DiMaggio and Powell 1983; Scott 2013). They are continuously reproduced by the social behaviour of their actors, and therefore become a take-for-granted environment for those actors reproducing it, as well as controlling for those not reproducing it (DiMaggio and Powell 1983; Scott 2013).

B.4.5 Complementarity of Coordination Themes

Building on the derived themes of coordination and in order to provide an integrated view on coordination, we discuss relationships and complementarity of the four themes. In effect, the presented themes of coordination are not mutually exclusive. On the contrary, they shape a basis for the other themes or complement one another.

As the most basic coordination theme, the informing theme serves as the fundamental basis for all other themes in managing interdependencies among different actors. Being present in both explicit and implicit forms (Nonaka 1994), informing means are required for realizing any form of socialization (lateral relations), control (hierarchical structures), and legitimation (e.g., see Granovetter 1973; Jensen and Meckling 1976; Schein 2010). While the informing theme can be perceived as the constitutive coordination means of the other themes, the legitimating theme serves as an overarching theme in which all themes of coordination interact. As such, the legitimating theme reaches beyond the themes of informing, controlling, or socializing, and that both structures and is structured by other themes (what structuration theory similarly describes as "interplay",

see Giddens 1984): For example, legitimacy structures controlling/socializing environments and, in turn, becomes structured by changes and developments of controlling/socializing environments (DiMaggio and Powell 1983).

Moreover, both the controlling and socializing themes complement each other in terms of hierarchical and lateral relations as well as interdependencies among actors. The controlling theme outlines a hierarchical structure of mechanisms, often top-down, and particularly applies centralized mechanisms for coping with interdependencies (Tsai 2002). In contrast to hierarchical structures, the socializing theme encompasses more personal, lateral modes of coordination (Nahapiet and Ghosal 1998). Taking into account that most organizational activities do not follow hierarchical structures (Galbraith 1973; Tsai 2002), social/lateral structures become an effective complement to any coordination theme in the form of control.

B.5 Conclusion

This research was motivated by the role of coordination as a lens to examine different organizational (Crowston 1997) and, in particular, IS (Brown 1997; DeSanctis and Jackson 1994) phenomena. Although conceptual (Van de Ven et al. 1976) and theoretical (Crowston 1997; Malone and Crowston 1990; 1994) approaches have been made, this research was further motivated by the fact that there is no factual theory on coordination. Facing demands of contributing to coordination (theory) in an interdisciplinary way (Malone and Crowston 1990), this research reports a thematic analysis on coordination by using IS reference theories that are rooted in various disciplines. While there are studies addressing coordination in specific IS phenomena, this study laid emphasis on coordination itself as a lens.

Building on a systematic research process, we investigated IS reference theories that implicitly approach coordination. Drawing on 16 theories, we conducted a thematic analysis, and synthesized the implicit reflection of coordination in IS reference theories to four themes of coordination namely, informing, socializing, controlling, and legitimating. We also provided the underpinning concepts and purposes of each of the derived themes. All of these themes necessarily include a coordination-enabling perspective regarding actors, interdependencies, and underlying mechanisms. We finally elaborated on the complementarity of the derived themes in order to cater an integrated, coherent view on coordination. In all, there was considerable support from the investigated theories that strengthened the synthesized themes.

While building on Malone and Crowston (1990), our study complements their research by going beyond merely conceptualizing coordination and its constitutive elements. Our study, in turn, proposes theory-grounded themes to guide prospective research in investigating IS phenomena through the lens of coordination. Further, there is a constant debate in IS research where, and for which problem settings to use theoretical lenses (e.g., Walsham 2006). As coordination represents an interdisciplinary lens, the identified themes and their related theories (theoretical discourses) can guide the application of theoretical lenses in different disciplines of IS research.

Besides the above-mentioned contributions to existing body of theory on coordination, our research offers new approaches in employing coordination as a theoretical lens in the studies of enterprise-wide IS undertakings. Coordinating various IS change and development projects to ensure an enterprise-wide perspective has long been the dominant topic of interest in disciplines, such as IS governance and enterprise architecture. Nevertheless, in enterprise architecture discipline, for instance, the existing studies merely rely on strict governance procedures (Boh and Yellin 2006; Peristeras and Tarabanis 2000; Richardson et al. 1990) that not only are challenging in deployment, but also do not sufficiently leverage the intended enterprise-wide approach (Ross and Quaadgras 2012; Winter 2014). The latter is yet mainly related to the controlling theme of coordination. As discussed in section B.4.5, all of the derived themes of coordination are of importance to be taken into account due to their complementarity. As such, the formulated concepts and purposes of informing, socializing, controlling, and legitimating themes can not only open new avenues of research through employing different themes of coordination, but also help scholars provide a multifaceted and exhaustive view on their phenomena of interest.

The main limitation of this study concerns the number of investigated reference theories. First, we acknowledge that there could be other theories that implicitly deal with coordination, and that can be incorporated to this study. As we are interested in the application of theories in IS, we nevertheless have investigated theories that are applied, in one way or another, in IS research. Second, having 16 theories in our analysis prevented us conducting an in-depth investigation of each theory. Despite this factual limitation, by selecting seminal studies, which developed the respective theories, as well as the most recent application of theories in IS literature, we ensured of capturing the main theoretical assumptions of the investigated theories.

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Paper C – The Institutional Logic of Harmonization: Local versus Global Perspectives

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Abstract

Perspectives in organizations differ to which extent information systems (IS) should be tailored towards local (e.g., business unit) needs or towards organization-wide, global goals (e.g., synergies, integration). For contributing to overall IS performance success, the harmonization of different perspectives becomes essential. While many scholars have highlighted the role of IS management approaches, institutional studies argue that harmonization is not solely the result of managerial action, but a consequence of institutional pressures that guide organizational decision-making. In the paper at hand, we follow the call for adopting institutional theory on the intra-organizational level of analysis and study the logic of attaining harmonization along institutional pressures. By means of a revelatory case study, we find harmonization attained in a dynamic interplay

between different institutional pressures. Mimetic pressures influence normative pressures, which in turn influence coercive pressures. Our findings as well as our implications for enterprise engineering guide prospective research in studying the attainment of harmonization through an institutional lens.

Keywords

Institutional theory, institutional pressures, harmonization

C.1 Introduction

In virtue of ever-growing complex organizational environments, perspectives on the development of information systems (IS) differ on whether to meet local business needs or organization-wide, global IS performance goals (Williams and Karahanna 2013). While tailored IS solutions may support local business unit operations (Peterson 2004), cost efficiencies and synergies are said to become realized through aligned and consistent IS landscapes at the global level, which requires harmonization efforts (Pawlowski and Robey 2004). Consequently, it has become the underpinning rationale of numerous IS management approaches to harmonize local (i.e. business unit) needs with global (i.e. organization-wide) goals (Sambamurthy and Zmud 2000). Yet, Mignerat and Rivard (2009, p. 369) posit that researchers might not be able to explain "everything that happens in organizations by considering only rational actions of managers". For studying how global goals are achieved, the *institutional logic* that surrounds decision-makers in exercising their tasks needs to be considered, and requires a closer investigation (Orlikowski and Barley 2001).

Institutional logic is defined as the patterns of rules, values, assumptions, and beliefs by which individuals (re-)produce their material subsistence, organize time and space, and provide meaning to their social reality (Thornton and Ocasio 1999). It intends to explain the formal and informal rationales of action and interaction for accomplishing organizational goals and tasks (Ocasio 1997; Scott 2014). Institutional logic is promoted by institutional theory, which is among the most vibrant theoretical lenses in IS research (Mignerat and Rivard 2009). However, to date, institutional theory has been applied mainly at the *inter-organizational* level, i.e. explaining harmonization between organizations.

In the paper at hand, we follow several calls in the root discipline of institutional theory (Dacin et al. 2002; Greenwood and Hinings 1996; Greenwood et al. 2008; Pache and Santos 2013a) as well as in IS research (Mignerat and Rivard 2009) and take an *intra-*

organizational perspective through a revelatory case study of a highly decentralized organization. High decentralization is a well-suited structure for our purpose as it helps to translate the setting of pressures among different organizations into a setting of pressures among different units within an organization. We thus aim to learn how the distinctive influence of each pressure alone as well as the dynamic influence of pressures interacting (e.g., shaping, constraining, or constituting each other among different units) contribute to the attainment of harmonization. We seek to answer the following research question:

What is the institutional logic of harmonization in a decentralized organization?

The remainder of this paper is structured as follows: first, we provide the theoretical foundation, i.e. institutional theory, its state of research in IS, as well as the research gap along which we position our contribution. Next to the research method, the case analysis is presented, following the reflection of institutional pressures and their influence. We conclude by discussing implications of our insights for future research.

C.2 Theoretical Background

C.2.1 Institutional Theory

Institutional theory (DiMaggio and Powell 2000; Meyer and Rowan 1977; Zucker 1977) understands organizations as social constructions, which seek to gain legitimacy in their environment. To gain legitimacy, organizations must adhere to assumptions, values, beliefs, and rules that are prevailing in their environment. In turn, adhering to a common set of assumptions, values, beliefs, and rules leads organizations to become homogenous over each other, i.e. a state of harmonization, which shapes and constrains organizational action and behavior (Scott 2014).

Numerous theorists have contributed to explain how harmonization becomes attained. More prominently, regulative, normative, and cultural systems have been associated by theorists as "vital ingredients of institutions" (Scott 2014, p. 59). These associations are particularly reflected in the three *institutional pressures* introduced by Dimaggio and Powell (2000), namely, *coercive*, *normative*, and *mimetic pressures*. Theory further argues that each pressure is catered by types of *carriers*, namely, symbolic systems (coded meaningful information), relational systems (horizontal and vertical structures fostering commitment), activities (actions, routines), and artifacts (objects, materials) (Scott

2014). Coercive pressures build on the logic of instrumentality, through which organizations constrain and regularize behavior. Rules, laws, or sanctions are prominent carriers. Normative pressures introduce an obligatory dimension into social life to which behaviors can be compared. Normative pressures are typically carried by values, norms, and standards, building on the logic of appropriateness and social obligations. Finally, mimetic pressures result from similar responses to uncertainty and refer to the imitation of one organization seen by another as more legitimate or successful, following the logic of perceived benefits. Observation, communication, and the work climate are prominent carriers of mimetic pressures.

IS research has applied institutional theory as a lens on a variety of settings, such as IS innovation, IS implementation, and IS adoption (Mignerat and Rivard 2009; Nielsen et al. 2014). A growing body of work thereby explicates the importance of institutional pressures on the inter-organizational level, leading to harmonized courses of action between organizations (Mignerat and Rivard 2009). For instance, Teo et al. (2003) found that all three pressures work in parallel and respectively have an influence on an organization's intention to adopt IS. However, they found that pressures' effects vary in strength with regards to the level of exertion (competitors, parent organization, customers, and suppliers). Pressures also vary due to different firm characteristics (i.e. dominant/less dominant market player), a perspective that has been promoted by Bala and Venkatesh (2007). While working simultaneously, pressures are also shaped by external influences: Liang et al. (2007), for instance, examined mediating effects on external institutional pressures, highlighting the role of top management on information technology (IT) assimilation. Furthermore, the combination of institutional pressures may vary over time. For instance, Benders et al. (2006) found varying effects and strengths of institutional pressures over several IS adoption phases. Finally, Nielsen et al. (2014) demonstrated that organizations change their responses to institutional pressures over time. Their findings broadened the understanding of institutional pressures, reflecting organizational concerns of conformity and nonconformity.

C.2.2 Intended Contribution

To date, the existing discourses in IS research on institutional theory mainly refer to the *inter-organizational level*, studying the influence of pressures on harmonization between organizations (Mignerat and Rivard 2009). According to Mignerat and Rivard's (2009) review of 53 IS studies that adopt institutional theory, only two focused the intra-

organizational level. In line with Greenwood et al.'s (2008) outline in organization science, Mignerat and Rivard (2009) motivate the adoption of institutional theory on the intra-organizational level—such as on/among units—for future IS research. We follow their call and study the attainment of harmonization along institutional pressures on the *intra-organizational level*.

Furthermore, the discourses in IS research illustrate pressures to work in combination (Mignerat and Rivard 2009), in different organizational contexts (e.g., Teo et al. 2003), as well as in different temporal circumstances (Benders et al. 2006). By shifting the focus from the organization as such to different units within an organization, we assume that harmonization may be explained by more than just the distinctive influence of each pressure separately. Particularly, we aim to account for the dynamics of institutional pressures interacting among different units, which may be shaping, constraining, or even constituting one another.

To develop a first understanding of how institutional pressures lead to harmonization in an intra-organizational setting, we study the *institutional logic*. Institutional logic intends to explain the patterns of rules, values, assumptions, and beliefs (i.e. carriers of institutional pressures) by which individuals (re-)produce their material subsistence, organize time and space, and provide meaning to their social reality (Thornton and Ocasio 1999). It explains the formal and informal rationales of action and interaction for accomplishing organizational goals and tasks (Ocasio 1997; Scott 2014). For our purpose, it may help to explain how local (i.e. business and IS) needs become harmonized with global business and IT goals. As organizations are infused with various (often competing) rationales of what constitutes global goals and how to pursue these, institutional logic may be well-suited to explain the distinctive as well as the dynamic influence of institutional pressures in place (Friedland and Alford 1991). In recent years, institutional logic has been pertinently used for explaining how intra-organizational processes affect organizational goals, change, and success (Almandoz 2012; Currie and Guah 2007; Tilcsik 2010).

C.3 Research Method

Case studies are a dominantly used approach for studying institutional logic (Currie and Guah 2007; Gosain 2004; Jensen et al. 2009). We selected a single case along the criteria of criticalness and revelatory insights, conducting a series of twelve semi-structured in-

terviews (Yin 2003). Following our research objective, we opted for a highly decentralized organization, operating under labor division and granted autonomy. This structure may be well-suited to explain how unbounded local units, focused on meeting specific demands of their respective customers, may become guided towards global goals. High decentralization also helped us magnifying the focus on the (dynamic) influence of institutional pressures within and between different units as well as between local and global levels.

C.3.1 Case Description

The case organization is one of the Europe's leading providers of public services in its respective field. With a yearly operating budget of over €200 million and more than 3,000 employees, it supplies its services to over 8,000 international customers on three continents namely, South America, Europe, and Eastern Asia. Additionally, the organization has over 50 partnership agreements with peer organizations around the world. The organization is structured highly decentralized: while adhering to shared global goals, the attainment of these goals is left autonomously in the hands of its local units. Overall, the organization offers four types of services. The first is a standardized service for a heterogeneous market of about 7,000 customers. The second is specialized and tailored to an exclusive market of around 1,000 customers. The third service type is a knowledge-centered public service, offered to a small market of international experts. The fourth service type is also knowledge-centered, however, mostly offered locally.

Global business. The organization is operating under a global management board. Its president is temporarily elected out of the over 100 local business unit managers, being responsible for supervising the legitimacy of internal decisions. Three vice-presidents support the president in the fields of services, internal operations, and international relations. While decisions are exercised through the board of management, decision-making is commissioned by an authorized committee. This committee consolidates goals and interests of local units by the leading business unit managers, who are members of this committee.

Global IT. The global IT department employs around 50 full-time equivalents and is headed by the Chief Information Officer (CIO). The CIO manages the project portfolio and stands in close contact with the global business. In total, up to 50 projects on different levels of complexity are run simultaneously by the global IT department, ranging from large, global transformation projects to daily business incidents.

Local business. In total, there are over 1,000 local employees and over 100 leading service managers in around 40 business units. While specialized on their respective market segment, they operate autonomously. For service types 1 and 2, business units are interdependent and have to align their activities with other local units and the global business level. Service types 3 and 4 follow individual market segments. As local units are not interdependent in service 3 and 4, no alignment is necessary there.

Local IT. The local IT are independently operating units in the organization and complement the global IT. The business support as well as their modes of operation lie autonomously in the hands of the local IT. Currently, five business units exclusively employ local IT for their operational support. The strengths of the local IT are primarily a quicker and more flexible mode of operation—as compared to the global IT—such as in technological (e.g., tool support, incidents) and business process solutions.

C.3.2 Data Collection

The data collection took place between November 2016 and November 2017. The collection comprised empirical data from primary and secondary sources.

Primary sources refer to the interviews conducted in the organization. In total, we conducted twelve semi-structured interviews under the thematic frame of the three institutional pressures. Each of the three interview parts started with a structured question, followed by an open discussion for collecting carriers of institutional pressures:

1) Coercive: "What are the rules, laws, regulations, guidelines or sanctions that direct local goals to global goals?"
2) Normative: "What are the behaviors, norms, values, ideals, or philosophies that direct local goals to global goals?"
3) Mimetic: "What are your perceptions, thoughts, beliefs, routines or best-practices that direct local goals to global goals?

Following our research objectives of understanding the logic of harmonization from an organizational (not solely IS-specific) perspective, interviewees were chosen from four distinct areas (Table 16): business global, business local, IT global, and IT local. All interviews were recorded and transcribed. Complementing our interviews by secondary sources allowed a triangulation of the data. We used different sources to gain an in-depth understanding of the organization's structure, goals, functions, roles, and dependencies. We studied organigrams, regulations, job descriptions, annual reports, strategies, mission/vision statements, newspaper articles and the content of webpages.

Role		Function (Length)
Global Business	Vice-president	Director of internal operations (60min)
	Vice-president	Director of administration (60min)
	Vice-president	Director of corporate services (60min)
Global IT	CIO	Director of IT administration and services (90min)
	Head of global unit	Responsible for service evolution (60min)
Local Business	Head of local unit	Mainly engaged in service 1, 2, and 3 (60min)
	Head of local unit	Mainly engaged in service 4 (60min)
	Head of local unit	Engaged in service 1, 2, 3, and 4 (60min)
	Head of local unit	Engaged in service 1, 2, 3, and 4 (60min)
	Member of local unit	Mainly engaged in service 1 and 3 (90min)
Local IT	IT Service Manager	Engaged in central IT administration (60min)
	Head of local IT	Engaged in local IT administration/services (90min)

Table 16: Profiles of Interviewees

C.3.3 Scheme-guided Analysis

Following Miles and Hubermann (1994) as well as Eisenhardt (1989b), the data analysis was divided into two phases: *coding* and *case analysis* (next section). The coding scheme was developed based on the three institutional pressures promoted by institutional theory (Scott 2014). These were studied on both local (operational units) and global (administrative units) levels. Table 17 illustrates our analysis scheme (adapted from (Scott 2014)).

Pressures	Coercive	Normative	Mimetic
Global Level	Examples: • Rules, regulations • Sanctions • Incentives	Examples: • Values, norms • Standards • Expectations	Examples: • Thoughts, beliefs • Shared understanding • Work culture/climate
Local Level			

Table 17: Coding Scheme adapted from (Scott 2014)

We coded the entire case transcript using Atlas.ti software. In order to identify institutional pressures, we followed Scott's (2014, p. 60) theoretical descriptions as well as illustrative examples of carriers (Table 17). Consistent with Scott (2014), we considered

the reflection of pressures via symbolic systems, relational systems, activities, and artifacts.

C.4 Case Analysis

In the following, we describe the identified carriers reflecting the pressures that contribute to the attainment of harmonization in the organization. Consistent with our focus of analysis, we study the reflection of pressures on global and local business and IT levels. We report on the both distinctive (i.e. separate) as well as dynamic (i.e. interacting) influence of pressures.

C.4.1 Institutional Pressures

Coercive pressures. At the global business level, coercive pressures are carried by the overall vision and strategy. Vision and strategy reflect negotiated compromises of the organization's committee. They comprise a global business orientation, which is used to initiate and direct local change and development projects. Furthermore, the global business monitors and evaluates standards of local business service. Together with the global business, the global IT develops IT-related parts of the overall strategy. For operationalizing IT-related strategies, the global IT is in constant negotiation with the global business for the allocation of budgets. Towards the local business, the global IT is required to steer IT developments that either operationalize global goals or non-standardized business support solutions. Despite these regulations, the global IT is granted autonomy in pursuing technological support for the local business.

On the local business level, coercive pressures are reflected in the standardization of services, in strict definitions of service processes and minimum quality requirements. For developing technological solutions to which no standardized products exist, the global business requires mandatory consultancies from local business units with the IT. Despite these consultancies and the minimum quality requirements, there are no coercive pressures on the operations of local business units. Moreover, autonomy is granted by the regulation not to regulate local units' operations. By granted autonomy, local units specialize in tasks and labor to supply their services to their respective market, guided by the global frame of vision and strategies. The local IT is constrained by budgets, which are allocated by the global IT and the local business level. For services that support the global IT, the local IT takes advantage of financial subsidies from the global IT. Yet, the operationalization of local business demands lies autonomously in the hands of the local IT and is not further regulated.

Normative pressures. At the global business level, normative pressures are carried by norms, values, and the overall identity. Norms focus the generation of quality and innovativeness in outputs and services, comprising desired performance towards the customer. Values refer to the organization's brand and reputation, creating a common desire of belonging and foster the motivation to actively engage in corporate development. Another major carrier of normative pressures is the committee, which comprises over 100 representatives from global and local levels with the goal of corporate development. While decisions are executed at the global business level, the committee collects and negotiates contesting and potentially conflicting local goals and expectations, fostering a compromise among these. Compromises then become externalized in vision and strategies. Finally, identity is among the normative pressures, carrying the meaning attached to goals that are negotiated among local and global levels. Moreover, identity encompasses shared expectations, such as towards roles and contributions. The global IT shares values and norms of the global business, understanding its role as supporting function for the global business. In order to excel support, the global IT employs high standards of technical resources deployment as well as personnel capabilities. Due to high standards, the global IT becomes involved in organizational development regarding IT-related aspects in global vision and strategies.

As local units serve different markets, they differ with regards to norms and values. Expectations to pursue these values are also specific, differing particularly within local units: while having a strong team focus, unit members value specializations in tasks as well as their different levels of knowledge and expertise. In turn, they value pro-active engagement in corporate development. As local unit representatives are members of the committee, contesting and potentially conflicting goals, norms, values, and expectations become mutually negotiated towards a global compromise. Operating autonomously, the local IT understands its role as a flexible business support provider. Local IT units operate directly with the business, independently from global supervision. Service orientation, while not directly delivering on the organization's output, drives the local IT. The mode of working within the local IT is similarly characterized by a high degree of flexibility in pursuing operations (emphasizing a service way of thinking).

Mimetic pressures. At the global business level, mimetic pressures are triggered by transparent communication channels and an endorsed feedback culture. Transparent channels of communication foster the exchange of knowledge and experience among

global and local levels. Thereby, the global business learns how overall goals are operationalized, and what best practices or performance challenges resulted. In this vein, personal contact and bilateral communication between global and local representatives is valued and encouraged for a shared understanding on corporate development. Besides, the global business learns from the observation of industry competitors. At the global IT level, mimetic pressures are also triggered by observations: on the one side, the global IT observes the global business in joint operations, learning from a centralized body operating in a comparable administration function. On the other side, global IT units observe industry competitors in regular peer meetings, where project management practices, success stories, and field reports are shared. Communication and reporting channels as well as bilateral contact among global IT representatives follow this relation. Learnings and experience are also shared with the local IT based on personal contacts as well as the bilateral exchange of knowledge and best practices.

At the local business level, mimetic pressures are reflected in mutual perception and communication, supported by the work climate. Business units closely observe their counterparts' performance. Based on communicated knowledge, success stories, and best practices, they learn and derive benchmarks for their own operations. By the same token, learning and the derivation of benchmarks occurs within local business units: unit members value different qualifications of their colleagues (e.g., education backgrounds, specialized skills), by which they individually contest towards a greater performance of the respective unit. Especially trust, reliability, curiosity as well as the willingness to learn are important factors of the work climate that support communication and observation. The comparably small size of the local IT unit permits close physical colocation for mutual observation, helping local IT units' members to gather an understanding of best practices and success stories. As a result of pro-active endorsement of the local IT's supervisors, experience, knowledge, and learnings are collectively shared. Likewise, trust and reliability support communication and interaction on the local IT level.

C.4.2 Institutional Logic of Harmonization

Building on our analysis, in the following, we synthesize our findings into six pressure-specific propositions on explaining the institutional logic of harmonization attained in a decentralized organization. We further report on the dynamics between institutional pressures, deriving a seventh proposition on the interplay of pressures (Table 18).

P1	In decentralized organizations, ...	while local units adhere to their own coercive mechanisms, globally-enforced coercive pressures reflect a set of mutually negotiated compromises among local units.	Coercive Pressures
P2		global coercive pressures foster guided interaction among local units by providing a general orientation frame for decision-making.	
P3		local units retain their own distinctive norms and values, that are shared by the market segments in which they operate and compete.	Normative Pressures
P4		distinctions in norms and values among local units are negotiated at the global level towards a mutually-generated identity.	
P5		the appreciation of distinct qualifications and perception of best practices set the benchmarks within local units.	Mimetic Pressures
P6		the appreciation of distinct norms/values and perception of best practices set the benchmarks among local units.	
P7		harmonization becomes attained in a dynamic interplay between institutional pressures, i.e. between mimetic and normative as well as normative and coercive pressures.	Dynamics of Pressures
$P7_a$		coercive pressures are influenced by normative pressures.	
$P7_b$		normative pressures are influenced by mimetic pressures.	

Table 18: Propositions on Institutional Pressures and their Dynamics

In decentralized organizations, coercive pressures are not enforced from one level to another. They are a product of local and global negotiations of individual expectations to pursue valued ends. This leads to a compromise of goals and expectations, becoming reflected in a set of mutually-agreed mechanisms (e.g., vision) (P1). In effect, these mechanisms harmonize differences among local units and provide an orientation frame for decision-making towards valued ends (e.g., outputs) as well as guided interaction (e.g., transparency in communication) among local and global levels (P2).

Local levels adhere to individual norms and values. This mainly results from the specialization of local units as they operate and compete in different market segments. Therefore, each local unit shares the prevailing norms and values of their respective market segment (P3). In turn, normative pressures are also found to stimulate the adherence of local levels to global values (feeling of belonging). That is, local units engage in the negotiation of goals and expectations, which contributes not only to the finding of compromises, but also to an overall identity due to shared expectations (P4).

Communication channels allow for mimetic behavior within and among local units. Within local units, members appreciate different qualifications of their colleagues, all

contesting towards greater performance of the respective unit. Simultaneously, best practices are perceived as benchmarks for members' performance in their own unit (P5). This fosters the formation of cross-market knowledge among local units, which perform to different market segments, and eventually leverages mimetic behavior based on lessons learned from other market segments. Also, local units perceive best practices as benchmarks, triggering output performance on the global level (P6).

Coercive pressures are externalized in the organization's overall vision and strategies. Coercive carriers are the result of mutual agreements among local units on how to regulate and develop the overall business at the global level. The resultant compromises comprise norms, values, and expectations among global and local levels. This brings us to a dynamic interplay between coercive and normative pressure, in which coercive pressures are impacted by normative pressures that cater negotiated norms, values, and expectations of local units (P7a). At the local level, two types of normative pressures are reflected. One type originates in the specific market segment to which the respective local unit belongs. Consequently, local units try to gain legitimacy in their respective market through compliance with the given market's norms and values. The other type of normative pressures stems from the organization itself: as such, local units gain legitimacy in the organization through respecting shared norms and values among different local units. In effect, local units appreciate their differences, while deriving benchmarks from each other based on success stories and best practices. This fosters the rise and acquisition of common norms and values as local units try to mimic the behavior of their successful counterparts (P7b).

To conclude, the institutional logic of harmonization in highly decentralized organizations can be explained through a dynamic interplay between institutional pressures (P7). As local units try to mimic behavior of their successful counterparts, shared norms and values among local units become leveraged. In turn, shared norms and values become reflected in means to communicate and regulate them in the organization.

C.5 Discussion and Conclusion

Our research responds to recent calls for conducting institutional research on the *intra-organizational level of analysis* (Greenwood et al. 2008). We make two contributions: firstly, our results provide six pressure-specific propositions on the institutional logic of harmonization at the intra-organizational level, which are similarly supported by IS literature at the inter-organizational level (Bala and Venkatesh 2007; Benders et al. 2006;

Chatterjee et al. 2002; Davidson and Chismar 2007; Miranda and Kim 2006; Nicolaou 1999; Son and Benbasat 2007). Secondly, our results show the dynamics of institutional pressures, which are mutually interacting and constitutive. For prospective research, this finding provides new insights and offers a vantage point for discussion.

C.5.1 Contribution

For coercive pressures, we found diverging goals and expectations of local levels reflected in a set of mutually-negotiated mechanisms (*P1*). IS literature supports this finding at the inter-organizational level. For example, Bala and Venkatesh (2007) found that inter-organizational business process standards are co-developed by organizations to standardize their business processes as well as to strengthen their relations to other firms. Asset connectedness, resource synergies, and collaboration are aimed for mutually-developed standards. Our proposition that coercive pressures foster guided interaction among local units by providing an orientation frame for decision-making (*P2*) is also line with the inter-organizational IS literature: mechanisms that routinize decision-making, for instance the allocation of material or authorization of human resources, are shown to provide a regulative frame for guided decision-making (Miranda and Kim 2006; Son and Benbasat 2007).

Furthermore, we proposed normative pressures along distinctive norms, values, and beliefs of local levels (*P3*) as well as their negotiation at the global level towards a mutually-generated identity (*P4*). The distinctiveness of norms and values corresponds to the inter-organizational perspective (Chatterjee et al. 2002). A general assumption is that due to different spatial and hierarchical levels, norms, values, and beliefs differ in an organization (Lewis et al. 2003). Simultaneously, values, rationales, and opinions are shared within the organization and thus yield a collective, assimilated social structure (Chatterjee et al. 2002). Davidson and Chismar (2007), among others, discuss that expectations between actors may spill over to behavioral obligations. In turn, these obligations foster an overall “structure”, which shapes and provides meaning to organizational behavior (Davidson and Chismar 2007).

Mimetic pressures were reflected in the appreciation of distinct qualifications and perception of best practices that set benchmarks among local units (*P6*) as well as their members (*P5*). This is similarly uphold in inter-organizational IS studies, such as by Bala and Venkatesh (2007), who maintain that organizations have a competitive interest in expanding their relations to others to benefit from shared knowledge, IT/IS assets,

and routines. According to Nicolaou (1999, p. 140), communication and social relations among personnel help organizations to learn about each other's solutions and "whether they intend to or not, facilitate imitation of each others' developments and decisions." Benders et al. (2006) show that IS managers are attracted by best practices, which simultaneously leads to industry-wide standardized practices as a result of competitors that perceive successful practices as an opportunity to catch up in competition.

Finally, we discovered a distinctive logic, in which harmonization becomes attained in a dynamic interplay between pressures (*P7*). We find that mimetic pressures influence normative pressures ($P7_b$), which in turn influence coercive pressures ($P7_a$). Further, coercive pressures carry normative reflections throughout the organization. In the inter-organizational IS literature, we selectively found indications that coercive pressures may derive from normative pressures (e.g., Bala and Venkatesh 2007). Further, we found evidence that normative pressures are influenced by mimetic pressures (e.g., Chatterjee et al. 2002; Davidson and Chismar 2007; Lewis et al. 2003). However, our findings on the institutional logic, occurring dynamically from local to global levels in a distinctive interplay of mimetic, normative, and coercive pressures, respectively, lacks evidence in the existing IS literature. This is where our research contributes with new insights and simultaneously opens an avenue for prospective IS research.

C.5.2 Implications

Our findings have implications for the understanding of institutional theory on the intra-organizational level (*explanatory findings*) and the discipline of *enterprise engineering*.

Explanatory findings. Our findings show that harmonization emerges in a dynamic interplay between institutional pressures, a finding that goes beyond existing explanations on the distinctive influence of pressures. While IS research has studied how institutional pressures work in parallel (Mignerat and Rivard 2009), in different organizational contexts (Teo et al. 2003), as well as in different temporal circumstances (Benders et al. 2006), little is known about their dynamic, i.e. their interacting influence. Hence, we motivate to consider the dynamic influence of institutional pressures for future research.

While pressures are dynamic and their influence may change over time, there are also continuities, i.e. features that are highly stable and persisting in organizations. This is what institutional theory refers to as "imprinting" (Scott 2014). Such continuities may reflect particular norms, beliefs, rules or combined configurations of them (Scott 2014).

Our case shows one major continuity – the institutional logic – that was discovered as a persisting process, stable due to the constant negotiation of norms, values, and goals. Although IS scholars have started to focus more on longitudinal and historical examinations of institutional processes (e.g., Cousins and Robey 2005; Nickerson and Zur Muehlen 2006; Wang and Swanson 2007), a large extent of research so far neglects explicit considerations of stable and persisting features of organizations (Mignerat and Rivard 2009). Due to this shortcoming, we outline organizational imprinting as a topic for future research.

Enterprise engineering. In enterprise engineering (EE), a common discourse addresses the empowerment of individuals for accomplishing organizational goals and tasks (Hoogervorst 2009). Research has propagated to mitigate the Taylorist separation of global ("thinkers") and local ("workers") actors. To this end, our finding of local actors who negotiate global goals and tasks to pursue these has major implications for any approach to engineer the organization. For example, approaches that are coercive (e.g., strict architecture rules) and not balanced against goals, values, and expectations of local actors may risk ineffectiveness or non-conformity. This brings us to the following outline.

Regarding our findings on normative and mimetic pressures, it becomes evident that harmonization is a dynamic process that occurs along constantly re-negotiated institutional demands. Consequently, we motivate a more dynamic perspective on EE. In line with Hoogervorst (2009) who suggests to consider the unplanned, self-organizing, and emerging nature of organizational environments, we motivate to establish and pursue EE as a continuous process of considering and continuously negotiating goals, goals, values, beliefs, and best practices among different organizational levels (e.g., see also Faller and de Kinderen 2014; Faller et al. 2016). In line with our findings and EE research (Rouse and Baba 2006; Van Steenbergen 2011), feedback sessions, communication channels, and alignment meetings within and between organizational units may provide a pertinent avenue to dynamically establish and pursue EE over time.

C.5.3 Limitations

This research has limitations. In line with our research objective, we purposefully chose a highly decentralized organization. Yet, organizations differ by contextual factors and personal motives (Oliver 1991). In consequence, they also respond differently to insti-

tutional pressures. In order to generalize the discovered logic independent from contextual factors and motives, we suggest extending our single case approach by multiple case studies, enriching our qualitative data and conducting cross-case analyses.

Another limitation reconciles with this study's lack of considering timeliness. While demonstrating the attainment of harmonization as a dynamic process through interplaying pressures, our study neglects further insights on their temporal evolvement. Moreover, institutionalization is a process that occurs over time and thus raises the consideration of timeliness (Scott 2014). Historic conflicts, changes, or unforeseen events could lead to a deeper understanding of why some pressures are meaningful in a given situation or environment, while others are not. A longitudinal perspective may allow for deeper insights. Hence, we outline the consideration of timeliness in studying the attainment of harmonization (Dacin et al. 2002) complementarily to the future progress of this research.

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Paper D – A Learning Perspective on Enterprise Architecture Management

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Abstract

Enterprise architecture management (EAM) has long been propagated in research and practice as an approach for keeping local information systems projects in line with enterprise-wide, long-term objectives. EAM literature predominantly promotes strictly governed and centralized coordination mechanisms to achieve the promised alignment contributions. Notwithstanding the increasing maturity levels in practice, organizations still struggle with the successful establishment of EAM, mainly due to the inherent challenges of a firmly centralized approach in complex organizational settings. This study opts for cooperative learning as a theoretical lens to afford a distinctive, non-centralized conceptualization of EAM. We empirically demonstrate EAM as a stage-wise learning process in which knowledge acquisition and cooperative interactions among individuals contribute to project performance on the local level. Projects that benefit from this particular learning process, in turn, are found to significantly leverage enterprise-wide performance.

Keywords

Enterprise architecture management, project performance, enterprise-wide performance, cooperative learning, knowledge acquisition

D.1 Introduction

Over the past decades, increasing investments in corporate information systems (IS) have contributed to superior performance of organizations (Brynjolfsson and Hitt 2000; Melville et al. 2004). However, these increasing investments have also brought about an ever-growing number and diversity of technological solutions, which are costly to maintain and to integrate (Peterson 2004). This unbounded growth, among other reasons, has mainly resulted from allocating development budgets and project ownerships to local business units. Even though the latter fosters IS investments' alignment with business needs, it disregards an *enterprise-wide perspective* on the dependencies among local projects. Hence, for today's organizations, it has become vital to complement local project perspectives with enterprise-wide considerations in order to align diverse IS endeavors.

As a solution, scholars and practitioners have broadly propagated enterprise architecture management (EAM) as an organizing logic for business processes and their technological infrastructure to eventually align local projects with enterprise-wide objectives (Ross et al. 2006). Despite its prominence in IS research and notwithstanding the overall increasing maturity levels in practice (Ross and Quaadgras 2012), organizations still struggle with the successful establishment of EAM (Tamm et al. 2011). This is mainly due to the predominant approach to EAM as a strict and centralized governance practice to guide local IS investments (Aier et al. 2011; Boh and Yellin 2006). This centralized, top-down driven approach to EAM has been substantially promoted in Ross' (2003) reflection of EAM maturity levels (i.e., the more centralized, the more mature). Owing to the inherent challenges of a firmly centralized approach in complex organizational settings, it turned out that many organizations experience huge difficulties in establishing EAM (Haki et al. 2012), as it has been reflected in many failures of EAM endeavors (Löhe and Legner 2014). As such, the centralized approach to EAM has been subject to criticism and a complementary, non-centralized approach to EAM has recently been introduced through the notion of *architectural thinking* (Aier et al. 2015; Ross and Quaadgras 2012; Winter 2014). Architectural thinking targets local decision-makers, non-architects, and diverse (non-technical) stakeholders. It aims at applying enterprise-

wide considerations in local design decisions, thus aligning local solutions with enterprise-wide, long-term objectives.

After studying the evolvement of EAM as a maturity process in over 40 case studies (Ross 2003), Jeanne Ross and her colleagues at the Massachusetts Institute of Technology, one decade later, found that superior performance rather results from promoting architectural thinking (Ross and Quaadgras 2012). As an implication of their new findings, they motivated the study of EAM as a learning process through which individuals conjointly learn to consider enterprise-wide objectives in their local design decisions (Ross and Quaadgras 2012). Inspired by these recent insights, in this research we seek to empirically demonstrate the realization of EAM success through a non-centralized, non-governance-based learning process. Particularly, we aim at answering the following research question: *How does cooperative learning contribute to EAM success?*

Building on cooperative learning, as a theoretical lens, as well as EAM's extant body of knowledge, we derive a research model that hypothesizes the impact of knowledge acquisition and cooperative learning on both project and enterprise-wide performance contributions of EAM. We test the research model following a partial least squares (PLS) approach to structural equation modeling (SEM). Our resulted insights prove stage-wise performance contributions of cooperative learning on project and on enterprise-wide levels. We hence demonstrate the realization of EAM success through a non-governance-based learning process in which project-concerned stakeholders interact and cooperatively learn from each other in aligning local solutions with enterprise-wide objectives.

The remainder of this paper is structured as follows: first, we lay out the state of research and motivate learning as a lens to study EAM. Second, we derive our research model based on extant learning literature, and particularly where this literature applies to EAM performance contributions. Having operationalized constructs, collected data, and conducted validity tests, we finally present our results and conclude by a discussion on the resulted insights.

D.2 Literature Review

Since the 1980s (Zachman 1987), enterprise architecture (EA) has developed a steadily growing discourse in IS research (Simon et al. 2013). According to Niemann (2006, p. 21), EA refers to a structured, harmonized, and dynamic collection of plans for the development of an enterprise's information technology (IT) landscape that illustrates different aspects of IT systems and their alignment with the business. EA primarily aims

at catering an *enterprise-wide perspective* to IS investments—extending the focus of management beyond a single information system to achieve strategic, long-term objectives (Lange et al. 2015). As such, aligning different projects and stakeholders, with diverse and locally-oriented interests, and keeping their efforts in line with enterprise-wide objectives has become the *raison d'être* for EA management (EAM) (Boh and Yellin 2006). Consequently, expected contributions of EAM, such as IS effectiveness and efficiency, have often been measured at the enterprise-wide level (Lange et al. 2015; Schmidt and Buxmann 2011; Tamm et al. 2011).

To achieve these expected contributions, IS research has largely promoted EAM as a governance means, which exercises its efforts mainly from a centralized position in the hierarchy of an organization (Boh and Yellin 2006; Schmidt and Buxmann 2011). Following a top-down driven approach, EAM links and guides diverse project stakeholders through architecture artifacts, such as EA meta-models and modeling techniques (Jonkers et al. 2003; Lankhorst 2005), as well as through coordination mechanisms, such as EA standards and principles (Boh and Yellin 2006; Richardson et al. 1990). Nevertheless, EAM has often lacked flexibility in guiding organizational transitions that require considerable IS and organizational developments and transformations (Dietz and Hoogervorst 2008). More precisely, the centralized guidance of projects and stakeholders has often fallen short in adapting to organizational complexity as well as to the complexity of the IS landscape, which maintains thousands of applications to support various depending and interrelated business processes (Boh and Yellin 2006; Murer et al. 2010; Schmidt and Buxmann 2011). Shortcomings have also resulted from EAM's limited reach and impact on those stakeholders who are not directly related to IT (Gardner et al. 2012).

In order to tackle the above-mentioned challenges, EAM literature has recently started to promote non-centralized, light-weight approaches to EAM (Ross and Quaadgras 2012; Winter 2014). Nonetheless, extant literature lacks a systematic research to investigate and demonstrate the impact of such non-centralized (and mainly non-governed) approaches for achieving the expected contributions that have long been promised in the EAM literature. To fill this research gap, and by following Ross and Quaadgras' (2012) view on EAM as a learning process, this study opts for organizational learning in general, and cooperative learning in particular, as a theoretical lens to examine EAM's contribution to enterprise-wide performance.

Organizational learning is defined as a process of improving performance due to increased knowledge (Fiol and Lyles 1985). It has been widely favored as a lens for studying various organizational and IS phenomena. In order to stay competitive, organizations constantly attempt to improve their work practices (Huber 1991). Consequently, a coherent understanding of individuals and decision-makers that link and drive an organization's work practices becomes necessary (Brown and Duguid 1991). Therefore, learning literature has often laid emphasis on capturing work systems as interrelated social constructions generally, as well as understanding information exchange practices, collaboration and interaction among individuals particularly (Brown and Duguid 1991; 2001). By the same token, in IS research, organizational learning has found extensive application as a lens, for instance in studying the performance of cross-unit work practices or investigating individuals' performance in collaborative work practices (e.g. Cha et al. 2008; Leonardi and Bailey 2008). One of the main approaches to organizational learning is cooperative learning, which refers to a non-centralized, highly personalized, and collaborative form of organizational learning (Janz and Prasarnphanich 2003). Thereby, cooperative learning particularly focuses on personal interaction, interdependencies and social relations mechanisms for studying the realization of superior performance from a non-centralized perspective (Janz and Prasarnphanich 2003; Miller 1996). Similarly, in IS research, cooperative learning has often been applied for investigating collaborative interaction, task and goal dependencies among individuals (e.g. Leidner and Jarvenpaa 1995; Majchrzak et al. 2005).

In the next section, we derive the research model and its constitutive hypotheses based on the selected theoretical lens as well as its implications for EAM.

D.3 Hypotheses Development

In order to study how learning supports EAM's expected contributions, the research model consists of two blocks: (i) the *learning process* and (ii) the resulted *performance* from learning. (i) The process of learning is represented by two constitutive elements: the acquisition of knowledge and the cooperative behavior of individuals, being enabled and willing to share and apply knowledge in making decisions or in influencing others' decisions (Miller 1996). (ii) Performance evolves as a dynamic process, starting in fragmented stages at the individual level, increasing more and more to the project (team), and ultimately to the enterprise-wide level (Janz and Prasarnphanich 2003; Power and

Waddell 2004). For studying EAM performance, as the main focus is on guiding projects to achieve enterprise-wide objectives (Lange et al. 2015), the constitutive elements are both project and enterprise-wide performance effects (see Figure 9).

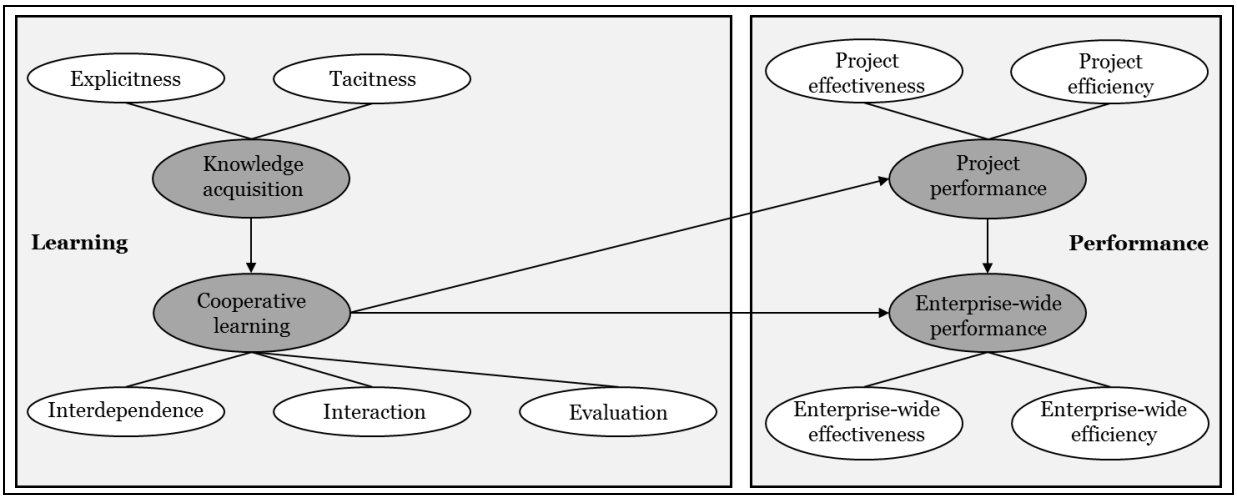

Figure 9: Research Model

D.3.1 Knowledge Acquisition and Cooperative Learning

Knowledge acquisition is the fundamental basis for organizational learning. Knowledge occurs in two forms namely, tacit and explicit knowledge (Nonaka 1994). *Tacit knowledge*, also referred to as highly personalized knowledge, is hard to formalize and to communicate (Polanyi 1966). It becomes visible to others when being actioned in commitment, involvement, or in behavior (Nonaka et al. 1994). Tacit knowledge becomes acquired by individuals through shared experience, observation or personalized interaction (Nonaka et al. 1994). *Explicit knowledge*, in turn, is a form of codified knowledge, containing information "that is transmittable in formal, systematic language" (Nonaka 1994, p. 16). It becomes acquired by individuals in rather formalized ways, for instance via shared documents, through enactive liaisoning, or by communication (Nonaka et al. 1994).

Cooperative learning builds on the acquisition of explicit and particularly tacit knowledge among individuals for the purpose of increasing their work performance (Janz and Prasarnphanich 2003). In its essence, the sharing and application of knowledge depends on the enablement and the willingness of individuals. Regarding the enablement, work in teams is typically structured in such a way that individuals depend on each other, and that no individual team member can successfully accomplish tasks without others being successful (Janz and Prasarnphanich 2003). In the process of learning, *interdependencies* hence become a personalized linkage for individuals and teams

to structure their knowledge, make it sharable (explicit) and thus applicable for others (Alavi and Leidner 2001). Furthermore, cooperative learning builds on team members' willingness in making knowledge acquirable, and in interacting with one another for accomplishing tasks (Janz and Prasarnphanich 2003). This *interaction* also relies on a personalized linkage between individuals for the purpose of externalizing, sharing and applying knowledge. In addition, cooperative learning aims at performance enhancements by evaluation, where the sharing and application of knowledge, towards expected purposes and outcomes, is reflected (Janz and Prasarnphanich 2003). This *evaluation* is necessary to detect and correct shortcomings in the process of learning, and is essential for maintaining a coherent knowledge base of the team in order to realize superior work performance. Maintaining a coherent knowledge base becomes especially relevant due to the fact that learning represents an unlasting effort. For instance, team members may fluctuate, project goals or task requirements change (Grant 1996; Janz and Prasarnphanich 2003), which requires individuals to continuously acquire, share and apply knowledge among one another.

One of the key functions associated with the EA is that it serves as a communication instrument among diverse stakeholder groups with different, however complementary, knowledge and expertise (Abraham et al. 2015; Jonkers et al. 2006). EA consequently links project-concerned stakeholders (who mainly follow local interests) with enterprise architects (who represent cross-project, enterprise-wide interests) and fosters effective interaction among them (Foorthuis et al. 2010). Having involved diverse groups of stakeholders, an active EA practice enables knowledge acquisition and integration (Van Steenbergen and Brinkkemper 2009) and eventually leverages a cooperative learning process.

We hence assume that work conducted on behalf of EAM is required to become a cooperative process of interaction, which is essentially dependent on the mutual acquisition of knowledge. We therefore hypothesize:

> *H1: In EAM efforts, knowledge acquisition is positively related to cooperative learning.*

D.3.2 Effects of Learning on Project and Enterprise-wide Performance

In the literature, the effects of learning have been investigated from two complementary perspectives namely, process and outcome perspectives (Janz and Prasarnphanich 2003; Power and Waddell 2004). On the one side, literature promotes a "process perspective", concerning the way learning as a process impacts performance. The process perspective

reflects the stage-wise evolvement of performance throughout the organization, i.e., from the individual level to the project, and from the project to the enterprise-wide level. On the other side, research has focused an "outcome perspective", shedding light on the effects of learning at each process level i.e., project and enterprise-wide levels. Cooperative learning promotes aligning outcomes at different process levels through interdependencies and interaction that extends the impact of learning processes beyond single projects and towards the enterprise-wide scope (Grover and Davenport 2001; Janz and Prasarnphanich 2003). Having captured "cooperative learning as a process", EAM performance contributions will be investigated from an "outcome perspective" at project and enterprise-wide levels.

EAM's prevalence as an approach is grounded on improving both project and enterprise-wide performance by guiding individuals in local IS project endeavors on behalf of enterprise-wide intentions (Lankhorst 2005). At the **project level**, EAM guides and specifies the project scope in order to further scale work activities (Bucher et al. 2006). As such, EAM enables knowledge integration among enterprise architects and their related project stakeholders, as well as among project stakeholders (Van Steenbergen and Brinkkemper 2009). Linking complementary knowledge holders to effectively interact with each other is hence expected to leverage work performance (Foorthuis et al. 2010). Therefore, local IS change and development projects achieve superior performance, reflected prevalently in *effectiveness* outcomes, such as delivering in higher quality or functionality, and in *efficiency* measures, such as delivering by reduced costs or by mitigated complexity (Lange et al. 2015; Schmidt and Buxmann 2011). We thus assume a positive relation between cooperative learning and project performance in EAM efforts:

> *H2: In EAM efforts, cooperative learning is positively related to project performance.*

The central promise of EAM is to guide multiple, interrelated projects (Boh et al. 2003) that without this guidance would favor local IS solutions at the expense of **enterprise-wide level** objectives. For effective cross-project guidance, EAM maintains architecture artifacts, such as models or meta-models, which act as boundaries objects among project stakeholders with complementary knowledge and heterogeneous requirements (Abraham 2013; Abraham et al. 2015; Lankhorst 2005). These artifacts help to overcome knowledge boundaries and thus foster learning among enterprise architects and project stakeholders across the horizon of local endeavors, towards enterprise-wide and long-term objectives (Van Steenbergen and Brinkkemper 2009). Initializing projects under EA guidance is shown to realize performance benefits enterprise-widely, prevalently

by *effectiveness* outcomes, such as the achievement of business goals or business-IT alignment, and *efficiency* outcomes such as mitigated organizational landscape complexity or harmonized IS solutions (Lange et al. 2015; Schmidt and Buxmann 2011). Hence, we hypothesize cooperative learning as being positively related to enterprise-wide performance in EAM efforts:

> *H3: In EAM efforts, cooperative learning is positively related to enterprise-wide performance.*

Building on the dynamic process of learning and its contributions to performance (Grover and Davenport 2001; Janz and Prasarnphanich 2003; Power and Waddell 2004), which evolves stage-wise from the individual to project and to enterprise-wide level, we expect a mediation of project performance on the relation between cooperative learning and enterprise-wide performance. As EAM-guided projects are locally focused on the one side, and their success is measured based on the contribution to enterprise-wide outcomes on the other side, there is considerable evidence in literature revealing a trade-off between the achievement of local versus enterprise-wide benefits (Ross and Quaadgras 2012; Weiss et al. 2013). EAM efforts aim at waiving this trade-off primarily by targeting IS project decision-makers, aligning them with enterprise-wide intentions, and hence guiding projects on behalf of enterprise-wide purposes (Lankhorst 2005; Schmidt and Buxmann 2011). Consequently, project performance enhancements are expected to mediate the relationship between cooperative learning and enterprise-wide performance. We hypothesize this relation as follows:

> *H4: In EAM efforts, project performance is positively related to enterprise-wide performance, reflecting a mediation of the relation between cooperative learning and enterprise-wide performance.*

D.4 Research Method

As motivated in the previous section, our research model comprises two major blocks, derived from knowledge acquisition and cooperative learning as well as from project and enterprise-wide performance. The model hypothesizes the relation between the constitutive constructs of these two blocks. In Figure 10, lines reflect the category of

measures for each construct, while arrows[3] represent the hypothesized (*H*) relations between the constructs.

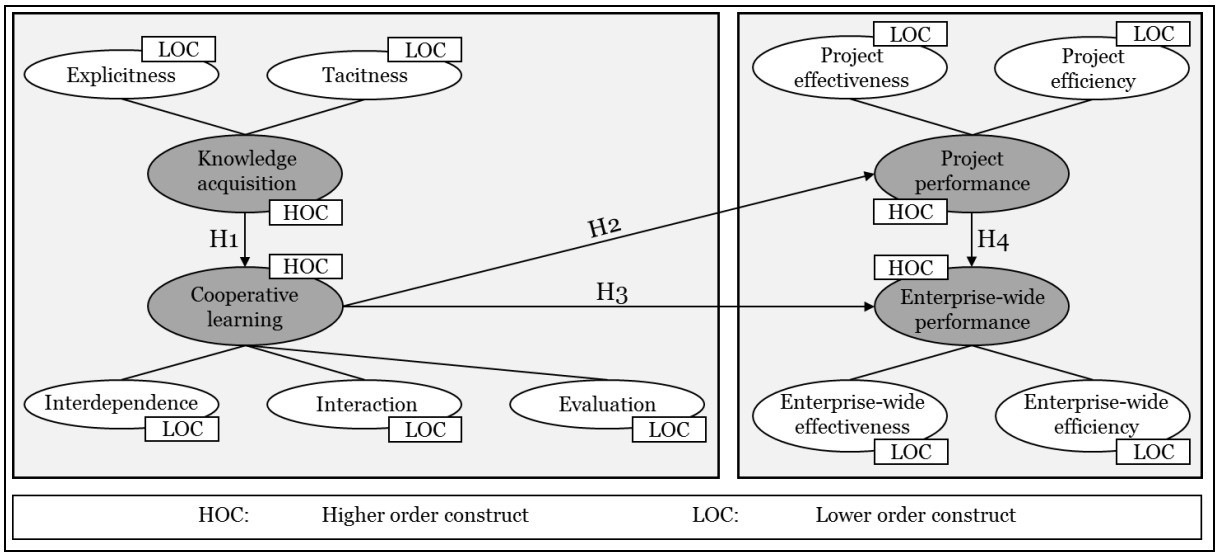

Figure 10: Research Model as a Higher-order Model

In effect, the research model is designed at a higher level of abstraction, i.e., as "higher-order model" (Chin 1998; Hair Jr. et al. 2014; Lohmöller 1989). As such, the described higher-order model comprises four higher-order constructs (HOC), relevant for testing the derived hypotheses, as well as of nine lower-order constructs (LOC), representing the reflected measures of the HOCs (Wilson and Henseler 2007).

Knowledge acquisition represents the fundamental basis for cooperative learning (*H1*). It is reflected by the two forms through which knowledge is formulated, namely, *tacitness* and *explicitness*. Cooperative learning enables the integration of acquired knowledge in projects (*H2*), and for aligning diverse projects and their stakeholders towards enterprise-wide considerations (*H3*). Cooperative learning is reflected by its three constitutive constructs, i.e. *interdependence*, *interaction*, and *evaluation*. As EAM performance contributions have often been measured through IS *effectiveness* and *efficiency* (e.g., Lange et al. 2015; Schmidt and Buxmann 2011), both project and enterprise-wide levels have been reflected by these two constructs. Drawing from projects' local focus and their ultimate evaluation in terms of their contribution to enterprise-wide

[3] There is a discussion in IS research on causal reasoning (Gregor and Hovorka 2011). In the research model, we do not address causality in the hypothesized relations.

performance, our research model reflects *H4* primarily as a mediation of project performance on the relation between cooperative learning and enterprise-wide performance, and secondarily as the relation between project and enterprise-wide performance.

In order to test the derived research model, the method of this research is designed in three steps, starting with the operationalization of constructs, followed by the collection of data, and finally the analysis of data.

D.4.1 Construct Operationalization

For the operationalization of constructs, we chose to adopt existing measurement items identified from the reviewed literature.

We measured *knowledge acquisition* with nine items, adopted from Lee and Choi (2003): five items thereby focusing on tacitness, and four items measuring the explicitness of the acquirable knowledge (see also Nonaka et al. 1994; Nonaka and Takeuchi 1995). *Cooperative learning* was measured by 19 items, adopted from Janz and Prasarnphanich (2003): ten items for interdependence (enablement to share and apply knowledge), six items for interaction (willingness to share and apply knowledge), and three items for the evaluation of shared and applied knowledge (see also Hult 1998; Johnson et al. 1988).

To fit to the purpose of our research, the originally extracted measurement items for both project and enterprise-wide performance (see Lange et al. 2015) were slightly adjusted in formulation, so that items explicitly focused performance contributions of EAM rather than EAM as a means for performance. Adapted from Lange et al. (2015), we employed eight items to reflect *project performance*, three of which measuring project effectiveness, and five of which measuring project efficiency. Finally, *enterprise-wide performance* was reflected by twelve items, also formulated based on Lange et al. (2015). Enterprise-wide effectiveness was measured by five items, while for enterprise-wide efficiency we employed seven measurement items.

In sum, we included a total of 48 items and measured them on a 5-point Likert scale, ranging from “strongly disagree” (1) to “strongly agree” (5). As the models’ measurement items are not a complete, exhaustive representation of the respective constructs, the constitutive constructs of the model are measured in a reflective, rather than formative, mode. This is due to the selection of measurement items for the specific objectives of our research.

D.4.2 Data Collection

We collected data by an online survey as well as by paper-based questionnaires. The paper-based collection took place between October and November 2015. Questionnaires were distributed at a workshop within an IS practitioner community and at two larger IS practitioner events. We used the practitioner workshop not only for collecting data, but also for testing face validity. Regarding face validity, we probed for clarity, wording and validity of the formulated measurement items in the questionnaire. Based on the successful pre-test, we continued data collection at two larger events and included the collected data from the questionnaire's pre-test step. We collected 118 responses in total by our paper-based questionnaires, having a response rate of approximately 71%.

We further launched an online survey from January to April 2016 for measuring exactly the same items. The survey was sent out to 581 contacts, to the large extent IT managers and enterprise architects. For the online survey, we collected 70 answers in total, having a response rate of approximately 12%. Of these 70 answers, we considered only those responses that covered at least 50% the measurement items (excluding demographic questions), which led to a reduced number of 33 responses. Together with the paper-based questionnaires, we totally collected 151 responses for further analysis. Missing values for measurement items in the responses were treated by mean replacement.

Besides the discussed measurement items, our survey also included five additional questions on demographics as well as on the functional and professional background of the respondents. Table 20 provides an overview on demographics, illustrating the industry as well as the staff size of the organizations to which respondents are affiliated.

Industry	**Percent**	**Company Staff Size**	**Percent**
Education	2.65%	< 10 employees	3.31%
Financial Services	17.88%	10 - 49 employees	3.97%
Healthcare	9.27%	50 - 99 employees	3.31%
Retail	1.99%	100 - 249 employees	1.99%
Information and Communication	7.95%	250 - 499 employees	4.64%
Insurance	7.28%	500 - 999 employees	6.62%
Manufacturing and Processing	10.60%	1000 - 4999 employees	18.54%
Public Administration	7.95%	>= 5000 employees	27.15%
Transport and Logistics	3.97%	No indication	30.47%
No indication	30.46%		

Table 20: Demographics of Survey Respondents

Since the focus of this research was on cooperative learning from both a process and outcome perspective, we opted for a diversified sample of EA audience. From the process perspective, and regarding respondents' hierarchical positions, we did not only survey managers and executives (as representative of enterprise-wide objectives), but also employees (as representative of local objectives) to provide an exhaustive analysis of learning as a non-centralized, stage-wise process. Likewise, the professional diversity of respondents allowed an analysis of learning outcomes throughout different organizational levels, focusing performance contributions at the local project and enterprise-wide level. The hierarchical positions, held by the surveyed respondents, were reported as employees (9.93%), team leaders (12.58%), unit leaders (21.19%), department leaders (10.60%), and executive managers (7.28%) (38.42% no indication). Regarding the professional background, 2.65% of the survey participants reported to have been working for less than one year, 3.97% between one and two years, 19.21% between three to five years, 21.85% between six and ten years, and 20.53% for more than ten years in their organization (31.79% no indication).

Furthermore, analyzing responses from both business and IT departments substantiated traditional EA performance measures, which mainly focuses on IT staff, towards an aligned perspective on performance measures. In their respective organizations, 35.76% of the respondents were primarily affiliated to IT units and 20.53% to business units (43.71% no indication).

In order to test for systematic measurement errors and bias in the estimates of the "true relations" among constructs (common methods bias), we considered *Harman's single-factor test* as supplemental analysis (Ringle et al. 2012). The results led to 25.35% of the variance explained, hence indicating that no single factor accounted for the majority (>50%) of covariance among the measures (Podsakoff et al. 2003).

D.4.3 Data Analysis

For analyzing data, we used PLS-SEM. We chose SEM in favor of other linear regression models in order to cope with the number of diverse indicators reflecting, rather than directly measuring, our constructs of interest (Gefen et al. 2011). We performed the test of the model by the PLS method, using the PLS implementation in SmartPLS, version 2.0.M3 (Ringle et al. 2005). We chose the PLS-SEM approach, contrary to other covariance-based approaches (e.g., LISREL, AMOS), as it has only soft distributional assumptions and modest sample size requirements (Chin 2010).

The bootstrapping resampling procedure, with a total number of 5,000 resamples, was applied in order to evaluate the stability of the estimates. The significances were determined by the (two-tailed) *t*-value.

D.5 Results

D.5.1 Measurement Model and Validity Tests

We evaluated the measurement model regarding *content validity*, *indicator reliability*, *construct reliability*, *convergent validity*, and *discriminant validity*. We further measured the model's *predictive accuracy* as well as its *predictive validity*.

Content validity refers to a subjective evaluation of the constructs' domain content, captured by their respective indicators. To ensure the content validity, the constructs and their constitutive measurement items are theory-driven, adopted from the respective literature (both learning and EA), and adapted to our context of interest.

Indicator reliability explains to which degree the variance of an indicator is explained by the underlying construct. To be reliable, indicators should have a factor loading of 0.7 or higher, while indicators below a value of 0.4 should always be removed from the model (Hair Jr. et al. 2014). After a pre-test of the model, 3 indicators were removed (2 items from interdependence and 1 item from project efficiency) due to a factor loading of below 0.4. In the final measurement model, indicators had an average loading value 0.7, and no indicator was below 0.4. As shown in Appendix A, all indicator loadings are highly significant at the 0.01 significance-level (*t*-value > 2.576).

Construct reliability specifies whether a construct is appropriately measured by its indicators. Commonly, construct reliability is evaluated by the composite reliability (CR) and Cronbach's alpha (CA). Desirable values for both CR and CA are above 0.6 (Hair Jr. et al. 2014). For both CR and CA, all constructs in our model reach value beyond this threshold (see Appendix B), which illustrates their reliability.

Convergent validity aims at analyzing to which degree a construct is explained by its indicators rather than by error terms (Gefen and Straub 2005). Following Hair Jr. et al. (2014), the average variance extracted (AVE) should be greater than 0.5. For most of the constructs, this is the case, however, 5 constructs remain with lower values (see Appendix B). Nevertheless, a convergent validity with an AVE value below 0.5 can still be acceptable, if the CR of the respective construct is higher than 0.6 (Fornell and Larcker 1981). As for all of these 5 constructs the CR is above the desired value of 0.6 (see Appendix B), no construct was withdrawn from the model.

Discriminant validity is assessed in order to evaluate the dissimilarity of the research model's constructs (Gefen and Straub 2005). It is especially necessary for the test of higher-order models (Hair Jr. et al. 2014), such as applied in our research. For testing the discriminant validity, we applied the Fornell-Larcker criterion, comparing the square roots of a construct's AVE with the other constructs' correlations. Specifically, when the square root of each construct's AVE is greater than the highest correlation with any other construct, discriminant validity is sufficient. In the case of higher-order models, the discriminant validity criteria do not apply for comparisons between higher level and lower level constructs, and neither between lower level constructs (Hair Jr. et al. 2014). Comparing the square root of AVE (main diagonal) in all rows and columns (see Appendix C), we find the discriminant validity criterion met.

Compared to the Fornell-Larcker criterion, a more sensitive approach to uncover potential lacks of discriminant validity has been recently introduced to variance-based SEM: the heterotrait-monotrait (HTMT) ratio of correlations (Henseler et al. 2015). Measuring the average of the heterotrait-heteromethod (item correlations across constructs) relative to the average of the monotrait-heteromethod (item correlations within the same construct) correlations, HTMT ratios below a threshold of 0.9 ($HTMT_{.90}$) are desirable. In our data, we found discriminant validity thoroughly established (see Appendix D).

The determination coefficient R^2 represents an important coefficient for measuring the model's *predictive accuracy*. The interpretation of R^2 is dependent on the broadness and complexity of the investigated constructs, however, there is no general recommendation of acceptable values (Hair Jr. et al. 2014). In our model, 23% of cooperative learning is explained by knowledge acquisition, 6% of project performance by cooperative learning, and finally 27% of enterprise-wide performance by both project performance and cooperative learning (see Appendix B).

In addition to the predictive accuracy, we tested the *predictive validity* of our research model by the non-parametric Stone-Geisser test (Geisser 1974; Stone 1974). For conducting the Stone-Geisser test, we used a blindfolding procedure with an omission distance of 7 in SmartPLS (Hair Jr. et al. 2014). All resulting Q^2 values, indicating the predictive relevance, had a value of larger than 0 (see Appendix B), which proves predictive validity for our model, meaning that our collected empirical data can be reconstructed using our research model and the PLS parameters (Götz et al. 2010).

D.5.2 Testing of Hypotheses

In Figure 11, we provide the final SEM. Arrows include the path coefficients between the constructs. To every arrow we added the value of the path coefficient as well as the significance level (based on two-tailed *t*-tests). The significant levels (***: $\alpha < 0.01$; **: $\alpha < 0.05$; *: $\alpha < 0.1$) were calculated by a bootstrap run in SmartPLS (Hair Jr. et al. 2014), calculated with 5000 samples. Based on the results provided in Figure 11, we present the test of hypotheses in the following (see Table 21).

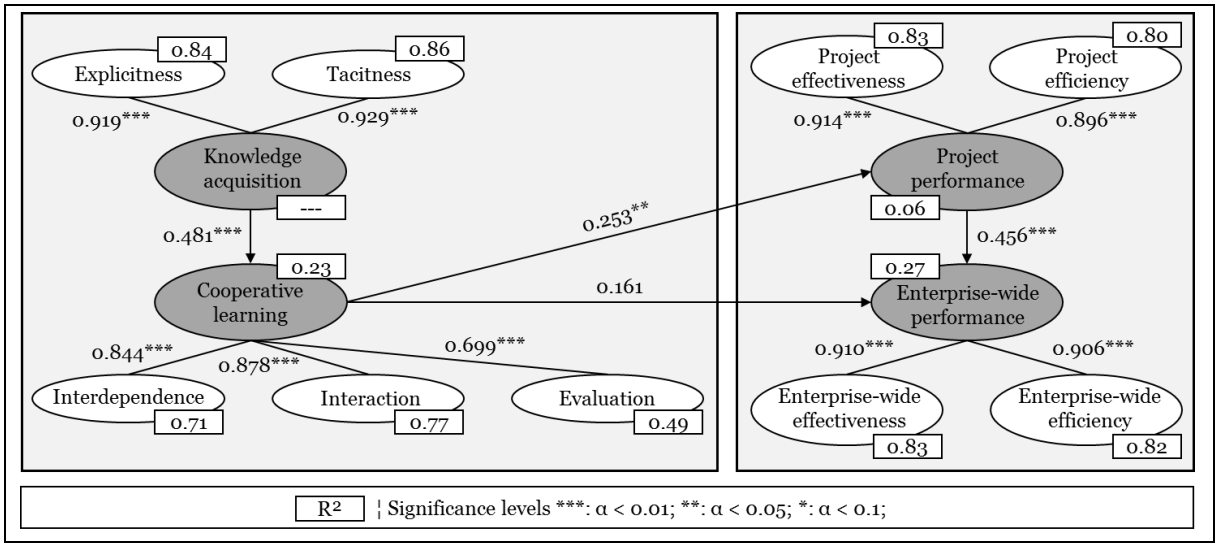

Figure 11: Research Model Results

We found a positive and significant relation between knowledge acquisition and cooperative learning, which supports *H1*. For the relation between cooperative learning and project performance, we also found a positive and significant relation, thus supporting *H2*. Between cooperative learning and enterprise-wide performance, we found a small positive relation, however, this relation was not found to be significant. Thus, *H3* is not supported by our data.

Hypothesis	Path description	Path coefficient and significance	*t*-value (two-tailed)	Result
H1	Knowledge creation → Cooperative learning	0.481***	5.838	Supported
H2	Cooperative learning → Project performance	0.253**	2.528	Supported
H3	Cooperative learning → Enterprise-wide performance	0.161	1.612	Not supported
H4	Project performance → Enterprise-wide performance	0.456***	4.555	Supported

Table 21: Test of Hypotheses

For the relation between project performance and enterprise-wide performance, we found a positive and significant relation, which supports *H4*. This hypothesis further assumes that project performance is not only positively related to enterprise-wide performance, but also mediates the relation between cooperative learning and enterprise-wide performance. We performed the Sobel test statistic in order to analyze whether project performance is a mediator that significantly carries the relation between cooperative learning and enterprise-wide performance. We used an online calculator for measuring the significance of the mediation by two-tailed probability values (Soper 2016). The test returned a highly significant mediation of project performance at a two-tailed *t*-value of 2.076. Hence, *H4* is also significantly supported as mediating the relation between cooperative learning and enterprise-wide performance in the form of a mediation effect.

D.6 Discussion and Conclusion

D.6.1 Summary

Through going beyond established views on EAM as a centralized governance means in the extant literature, we empirically demonstrate how cooperative learning, as a non-centralized process, leverages EAM's expected performance contributions. This brings us to a distinctive conceptualization of EAM endeavors, in which knowledge acquisition, cooperative and personalized interactions among individuals facilitate both project and enterprise-wide objectives. We hence contribute to the recently promoted non-centralized and learning view on EAM (Ross and Quaadgras 2012) through empirically illustrating EAM as a stage-wise learning process, reflecting enterprise-wide considerations at both project and individual levels.

Instead of taking either a process or outcome perspective to learning, which is dominant in the extant literature on learning, this study opts for a concerted view. This concerted view examines outcomes at different process levels through different mechanisms of cooperative learning. Building on this theoretically grounded basis and a statistically valid research model, we illustrate that performance enhancements evolve stage-wise from the individual to the enterprise-wide level. As such, the process of cooperative knowledge sharing and personalized interaction among individuals explains direct performance contributions at the level of local projects, while those projects with enhanced performance become in turn an impact means to enterprise-wide performance. This insight is in line with the essential assumption of architectural thinking, that concerns local decision-makers in the organization for guiding their endeavors in such a way that the

realization of project outcomes becomes beneficial to the organization as a whole (Ross and Quaadgras 2012; Winter 2014). The achievement of superior enterprise-wide performance thereby becomes the success criterion for evaluating project performance, to which individuals are aligned by the means of learning. In this learning process, performance evaluation is an essential construct in which purposes and expected outcomes of learning are reflected. This explains that cooperative learning is unlikely to have very direct relations to enterprise-wide performance effects, as enterprise-wide objectives are expected to be reflected in project performance measures, and that project performance therefore is the mediator to achieve enterprise-wide objectives.

D.6.2 Discussion

Our findings complement, and to some extent call for reconsidering the traditional approach to EAM as a highly centralized, governance-based means. In effect, EAM's notion roots in a control-oriented practice that is concerned with the direct reach of enterprise-wide outcomes. Therefore, in line with Ross and Quaadgras' (2012) perception of architectural thinking, our study entails a need for future EAM practice to be less focused on controlling the achievement of outcomes rather than on supporting the processes for achieving these outcomes. This can be reflected in "self-control" for local (especially non-IT) stakeholders and their associated projects to apply enterprise-wide considerations in their decisions. According to Henderson and Lee (1992), self-control reconsiders centralized, top-down driven means as "the extent to which an individual exercises freedom or autonomy to determine both what actions are required and how to execute these activities". Janz and Prasarnphanich (2003) propose autonomy as a relevant factor for supporting cooperative learning. As such, autonomy refers to a degree of decision-freedom for individuals to make decisions on their own and to determine necessary actions. In cooperative learning, individuals evaluate their performance autonomously to detect and correct errors in working towards expected outcomes (Janz and Prasarnphanich 2003), and hence learn how to guide their decisions on behalf of enterprise-wide objectives.

Even though our study spotlights the impact of cooperative learning on EAM performance contributions, there are a number of factors that vitally support and influence knowledge integration, personalized interaction, and collaborative work among individuals. Among these factors is the degree of centralization in the structure of the work environment. A decentralized structure flattens communication and cross-project con-

tact, thus extending the reach of interaction and cooperative relations, and further enabling organizational members' spontaneous involvement in work and tasks (Hopper 1990; Lee and Choi 2003). Furthermore, a low degree of formalization is supported by learning literature for achieving more flexibility (Lee and Choi 2003). More precisely, knowledge integration and learning lay less emphasis on formalized rules, standards or procedures (Ichijo et al. 1998). Since one of EAM's shortcomings results from the high degree of formalization (e.g., highly sophisticated tools, meta-models, and coordination mechanisms) (Aier et al. 2015), scholars explicitly promote architectural thinking as a "lightweight" approach to support individuals' consideration of enterprise-wide objectives in less formalized, less sophisticated ways (Winter 2014). Moreover, organizational culture represents an important antecedent to knowledge integration and cooperative interactions (e.g., see Aier 2014a; Niemietz et al. 2013; Van Steenbergen 2011). We consider culture as a mechanism that is being adopted both consciously (e.g., visible structure in work environment) and unconsciously (e.g., assumptions on espoused goals of the organization) by individuals as a way of perceiving and ultimately working in their environment (Schein 2010). In cooperative learning, Janz and Prasarnphanich (2003) suggest culture (i.e., "climate") as an encouraging mechanism for personal interaction, social relations, and as a result, cooperative learning (see also Cohen 1998; Davenport and Prusak 1998). Culture supports the integration of individuals in thoughts and actions (Schein 2010), which is favored by architectural thinking, promoting the application of enterprise-wide considerations among local stakeholders (Ross and Quaadgras 2012; Winter 2014), and thereby raising a reconsideration of centralized EAM means in cultural dimensions.

As today's organizations constantly attempt to improve their work processes by the means of learning, there is an ever-present need to maintain and develop organizational learning capabilities (Janz and Prasarnphanich 2003). Over the past decades, organizations have predominantly developed these capabilities by firmly centralized approaches to knowledge management (Lee and Choi 2003). Nevertheless, organizations have also become highly dependent on decentralized learning capabilities, such as collaborative efforts, heterogeneous expertise, and complementary knowledge levels that enable and realize superior performance contributions from local levels (Brown and Duguid 1991; 2001). Further, learning as a process is not necessarily reliant on formal or systematic capabilities. It is often less structural and becomes collocated as a collaborative and interactive process that raises impact to an organization's overall knowledge capabilities (Miller 1996). These findings commonly suggest a complementary understanding of

learning capabilities that draw from centralized approaches on the one side, and simultaneously rely on decentralized, more local considerations of organizational learning mechanisms on the other side.

While this study demonstrates the achievement of EAM performance by the means of a non-centralized learning process, we do not promote this non-governance-based approach as an alternative to traditional EAM. We rather consider it as a complementary view—as another side of the same coin. As illustrated in the extant literature, centralized procedures are required to institutionalize the reflection of enterprise-wide objectives in local and project-based endeavors. Simultaneously, as demonstrated in this study, the consideration of enterprise-wide objectives in local design decisions is a step-wise learning process that occurs in a non-centralized and bottom-up fashion. As such, depending on the context in which EAM is established, organizations try to reach an effective balance between giving autonomy to or strictly controlling local IS endeavors (Haki and Legner 2013a; Haki et al. 2012).

D.6.3 Limitations and Implications

This research has some limitations. Although we employ a theory-driven measurement model, we note a construct that might have been addressed with more appropriate indicators: interdependence. We found all indicators of interdependence with loadings below the common standard of 0.7 (Urbach and Ahlemann 2010). According to Hair Jr. et al. (2014), indicators of a value between 0.4 and 0.7 should only be considered for exclusion, if this exclusion leads to an increased AVE value. However, the step-wise exclusion of indicators led to a decrease in interdependence's AVE values, thus weakening convergent validity. Facing this comparable weak indicator reliability, we raise a reconsideration of interdependence' indicators.

Another limitation reconciles with this research's employed static approach. Specifically, the mediation of project performance on the relation between cooperative learning and enterprise-wide levels raises a consideration of timeliness in realizing enterprise-wide performance effects. Likewise, the discussed reconsideration of traditional, centralized EAM neglects further insights into development or evolvement of underlying mechanisms. These limitations all share the same implication, that is, an outline for future research to apply more longitudinal perspectives on the phenomenon of interest. Existing studies mainly take a static approach and investigate architecture endeavors in a specific point in time (Haki and Legner 2013a). Centralized approaches, described by traditional EAM, are less often followed as organizations and their individuals are

shaped by their cultural backgrounds (Schmidt and Buxmann 2011), which are not static in nature and evolve over time. Hjort-Madsen (2007) attests that the organizational adoption of EAM should be examined as an emergent, evolving, and social process, being shaped by cultural and structural forces in organizations. The same holds for the concept of architectural thinking as well as our discovered performance contributions of learning. This requires the investigation of non-centralized EAM performance contributions in a long journey. Prospective research may conduct a series of chronological analyses (instead of taking short-time, static grasp), for instance through longitudinal case studies, to eventually better understand the longitudinal dynamics and effects of learning on EAM performance contributions to project and enterprise-wide levels.

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Paper E – Motivation for Coordination – A Complementary Approach to Enterprise Architecture Management Research

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Abstract

Enterprise architecture management (EAM) is a prominent discipline that aims at guiding decisions in local information systems (IS) investments towards organization-wide objectives. Due to shortcomings resulting from the guidance of EAM as a strong hierarchical, top-down driven coordination practice, scholars have recently introduced the concept of architectural thinking. Complementary to top-down driven coordination, architectural thinking aims at local decision-makers for applying collectivistic considerations in their decisions and hence guiding IS endeavors beyond local utilities. Yet, the question of how to enable and foster this collectivistic orientation remains unanswered. Inspired by stewardship theory, this research conceptualizes a collectivistic-oriented decision-maker by the means of motivation. A literature review is conducted for identifying and exploring pertinent motivation mechanisms that foster the adoption of a collectivistic orientation among decision-makers, enriched with focus group data. To this end, five groups of situational and psychological mechanisms are reported. These findings

set out a guidance for prospective EAM research in approaching architectural coordination through a collectivistic orientation in decision-making.

Keywords

Enterprise architecture management, coordination, motivation, decision-making, stewardship theory

E.1 Introduction

As investments in corporate information systems (IS) have grown ever since, virtually all of today's organizations face progressive challenges in coordinating allocated technical resources and labor forces towards organization-wide aligned, consolidated, and manageable IS solutions (Peterson 2004). Local business (e.g., business unit) requirements, for changing or developing IS, affect multiple facets of an organization, and moreover involve a large number of stakeholders with heterogeneous concerns (Abraham and Aier 2012). In order to achieve beneficial IS solutions on the organization-wide level, projects must reach out beyond local considerations. While dealing with a significant inertia of structural, processual and technological complexities, one major constraint in achieving organization-wide considerations has been the local decision-maker: decisions that follow local demands or goals with disregards to collectivistic purposes represent a potential conflict for organization-wide benefits, and therefore require some form of coordination (Abraham and Aier 2012).

For several years, the enterprise architecture (EA) has been researched and applied as effective organizing logic for business process and the information technology (IT) infrastructure (Aier et al. 2015). EA management (EAM) goes beyond the descriptive logic of EA, enforcing a holistic guidance on local IS investments for maintaining and developing the EA (Winter and Fischer 2007). Despite its prominence in research, today's organizations still struggle with the successful establishment of EA (Aier et al. 2015). This mainly results from the dominant approach to EAM as a centralized, hierarchical practice for coordinating local decision-makers towards organization-wide, collectivistic objectives (Boh et al. 2003). More prevalently, EAM's shortcomings result from the restriction of local design decision freedom on the IT side, and from its too IT-related focus to involve "that other 90%" of affected decision-makers on the business side (Aier et al. 2015; Gardner et al. 2012). In long-term consequence, decisions in IS endeavors have remained beneficial to local rather than collectivistic levels (Murer et al. 2010).

More recently, a new concept has been introduced to EAM research, which proposes an alternative means-ends approach to hierarchical, governance-based forms of architectural coordination: *architectural thinking* (Winter 2014). Architectural thinking aims at local decision-makers for applying collectivistic considerations and organization-wide thinking, hence guiding their decisions in line with organization-wide intentions (Ross and Quaadgras 2012; Winter 2014). In order to approach this concept as a bottom-up, non-governed form of EAM practice, future research will be required on exploring mechanisms (defined as causes and means) that enable and foster architectural coordination through a collectivistic orientation in decision-making.

The paper at hand aims at contributing to future research on architectural coordination by deriving a new perspective on the phenomenon of interest: while prior research has theoretically built on a coordinated model of man in decision-making, this research opts for a distinctive conceptualization on a collectivistic orientation in decision-making, and for shedding light on pertinent mechanisms that enable and foster this orientation. Stewardship theory, a complementary approach to hierarchical governance, deploys the model of a collectivistic-oriented decision-maker (Davis et al. 1997). Parallel, stewardship theory emphasizes mechanisms that reconcile with motivation, fostering this collectivistic orientation, and that further set out a guidance for EAM research in approaching architectural coordination complementarily.

This research is structured as follows: first, the collectivistic orientation in decision-making is derived from theory, conceptualized, and next explored in EAM research. Second, stewardship theory is applied as research lens to conduct a literature review for identifying and exploring motivation mechanisms that foster the favored collectivistic orientation. Owing to the shortcomings of EAM practice, focus group data are collected and examined in order to enrich the qualitative findings. The explored mechanisms set out a guidance for EAM research towards a collectivistic orientation in decision-making; theoretical substantiations are implied.

E.2 Towards a Collectivistic Orientation in Decision-Making

E.2.1 Theoretical Conceptualization

Coordination is a key activity wherever tasks have to be solved by the division of labor (Galbraith 1973). Over the past century of economic research, one of the most prevalent assumptions made on decision-makers, who perform labor-divided tasks, is that of an economic actor, seeking to maximize his/her own benefits (Jensen and Meckling 1976).

At the core of contributions to organization theory has been a lens that portrays this prior economic research and human assumptions, promoting coordination as a means between a decision-maker and his/her principal in a labor-divided relation (Table 23): agency theory.

The coordinated decision-maker. Following agency theory (Jensen and Meckling 1976), the decision-maker in labor-divided tasks is assumed to maintain information beyond the knowledge base of the principal (i.e., asymmetry), and to behave self-interested with individual goals and preferences (Arrow 1964). These assumptions become a factual conflict as the principal needs to (re-)consider residual economic losses in achieving organizational goals, imposed and upheld by the decision-maker's individualistic behavior, and the asymmetry of information. As a result, some form of coordination is required, aimed at controlling the decision-maker. Ross (1973), Jensen and Meckling (1976) as well as Eisenhardt (1989a), among others, generalize the transferability of this coordination purpose to any form of labor division, in which at least one of the involved parties is assumed to increase his/her benefits against the respective goals of others.

The characteristics of coordination assume an environment, where a decision-maker can be controlled by the means of information. Though, coordination is not without any downside. Jensen and Meckling (1976) state the central discourse of agency theory in mitigating a trade-off between the benefits of achieving the principal's goals on the one side, and the economic cost of controlling these achievements on the other side. Eisenhardt (1985) illustrates this trade-off exemplary: first, investments in information can be undertaken to verify and coordinate the factual actions of the decision-maker, though causing cost of control. Second, relying on outcomes rather than processes of the decision-maker's work can be rewarded by the reach of outcomes, though risking opportunity cost if the decision-maker is wrongly rewarded. To this end, coordination by the means of information has remained controversially discussed (e.g., Davis et al. 1997; Eisenhardt 1989a).

The collectivistic-oriented decision-maker. Beyond agency theory's unit of analysis, stewardship theory (Table 23) offers a distinctive perspective on coordination, contrary to individualistic human assumptions in labor-divided settings (Davis et al. 1997). It deploys the model of a decision-maker who is "not motivated by individual goals", but rather behaves as steward, focused towards "pro-organizational behavior" and the goals of the collective (Davis et al. 1997). Cost of coordination become obsolete as diverging goals of the decision-maker no longer exist (Donaldson and Davis 1991). Given the

model of a rational rather than economic man, who emphasizes "higher value on cooperation than defection", stewardship theory focuses the coordination of decision-makers through behavioral means, and introduces motivation mechanisms for enabling and fostering this behavior (Davis et al. 1997).

Compared to agency theory's roots in economic research, stewardship theory has originated from sociology and psychology (Donaldson and Davis 1991). Rather than controlling behavior, the decision-maker's reward for collectivistic behavior is to attain the goals of the organization (Davis et al. 1997). Contrary to agency theory, behavior (not information) becomes the means of coordination. In the vein of sociological and psychological origins, mechanisms enhancing and fostering the aimed orientation reconcile with characteristics of motivation, which stewardship theory reveals as causes and means that guide behavior towards collectivistic ends. In stewardship theory, motivation is differentiated by psychological (e.g., intrinsic causes) and situational mechanisms (e.g., work-environmental factors) (Davis et al. 1997).

Although both theories conceptualize a virtually different model of man (Table 23), there is no substitution of stewardship on agency theory (Davis et al. 1997). Stewardship's model of man is a complementary approach to the traditional theorization of a coordinated decision-maker; it does not elude traditional coordination means, but coincides with behavioral aspects to it (Davis et al. 1997). By this conclusion, decision-making will be examined in EAM, specifically where stewardship's conceptualization becomes pertinent to architectural coordination.

Conceptualization	**Agency Theory**	**Stewardship Theory**
Model of man	Coordinated (economic decision-maker)	Motivated (non-economic decision-maker)
Coordination assumption	Information as coordination means; separation and specialization of work	Behavior as coordination means; cooperation higher valued than defection
Human assumption	Self-serving, individualistic behavior	Pro-organizational behavior, collectivism
Organizational assumption	Partial goal conflict among actors; economic criteria; information asymmetry	Aligned goals among actors; non-economic criteria
Mechanisms	Control of trade-off between benefits and economic cost associated with information asymmetry	Psychological and situational mechanisms that foster motivation

Table 23: Theoretical Conceptualization

E.2.2 Decision-Making in EAM

To achieve the expected performance effects from the EA, such as organization-wide consistent and aligned IS solutions, the distinguishing ambition of EAM is characterized by its holistic perspective: EAM considers the organization in its entirety, reaching out in horizontal (all artifacts per artifact type), vertical (all layers of the business-to-IT stack) and time (e.g., organizational development over several points in time) dimensions (Lankhorst 2005; Winter and Fischer 2007). In EAM, the holistic guidance of local IS decision-makers is governed from a centralized position in the organization, enforcing organization-wide perspectives in decision-making across dispersed organizational units as well as various depending and interrelated business processes (Weiss et al. 2013). As such, the holistic perspective of EAM has become particularly decisive to local levels, as decisions on even small local IS changes affect a potentially large number of business processes, workflows, and stakeholders with heterogeneous requirements (Murer et al. 2010).

The coordinated decision-maker. The model of man in decision-making is related to the work-environment that EAM research portrays as an organization in complexity, interdependencies, and size. An environment, where decisions are necessarily made in the context of labor division and specialization, and where these decisions potentially affect multiple facets of an organization (e.g., business processes, technical resources, stakeholders) (Abraham and Aier 2012). In the organization, architectural guidance is enforced and excelled by enterprise architects (Aier et al. 2015). Following the generalizations by Ross (1973), Jensen and Meckling (1976) as well as Eisenhardt (1989a), enterprise architects become principals in the meaning that they coordinate local decision-makers (e.g., IT specialists or business owners) on behalf of the EA. The conflict potential roots in human assumptions parallel to agency theory (Jensen and Meckling 1976): goals, needs, and perspectives of local decision-makers are often not coincide to their principals, who are in charge of governing organization-wide objectives (Aier et al. 2015; Niemi 2007). As local solutions follow local demands, they risk reluctance to organization-wide goals, which threatens the realization of local benefits at the expense of organization-wide benefits.

Similarly implied by agency theory (Jensen and Meckling 1976), information imposes a coordination means that is aimed at aligning and controlling local decision-makers towards organization-wide objectives. In EAM, information asymmetry occurs primarily in two major directions: top-down, organization-wide goals are not always made

aware and being followed by all local decision-maker levels of the organization (Ross and Quaadgras 2012; Winter 2014). Bottom-up, local specific capabilities are often limitedly reproducible (sometimes even limitedly understandable) by enterprise architects (Niemi 2007). The bulk of investments in information for harmonizing these asymmetries, thereby guiding local decision-makers, results in economic cost or efficiency shortcomings, similar suggested by the economic discourses of agency theory (e.g., Jensen and Meckling 1976; Ross 1973). In EAM efforts, information means are applied in the form of highly sophisticated artifacts like meta-models, professional plans or tools (Aier et al. 2015; Winter 2014), and mainly executed in a top-down driven direction (Asfaw et al. 2009; Gardner et al. 2012).

At the crossroads in EAM. Despite the importance of information as a coordination means, the factual shortcomings of EAM approaches have developed out of its strong centralized, hierarchical coordination practice. More specifically, architectural coordination has developed highly IT-focused, having incorporated rather IT- than business-affected decision-makers (e.g., see Aier et al. 2015). On the IT side, a frequent shortcoming of architectural coordination is the restriction of design freedom of IT-affected decision-makers. Furthermore, this IT-related focus has fallen short to become a meaning for "that other 90%" of the organization that is not related to IT (Aier et al. 2015; Gardner et al. 2012). Not least for this reason, architectural coordination has gradually faced an image problem among guided decision-makers over the past years. Once people talk about architectural concerns, "eyes start to roll" (Asfaw et al. 2009). In long-term consequence, IS solutions have remained often local/ short-term than organization-wide/long-term beneficial (Murer et al. 2010).

Towards a collectivistic-oriented decision-maker. Due to the shortcomings of traditional architectural coordination, EAM scholars have recently introduced an alternative means-ends approach by promoting "architectural thinking throughout the enterprise" for achieving organization-wide objectives in local decision-making (Ross and Quaadgras 2012). Aiming at local decision-makers, especially those not related to IT, to follow collectivistic considerations and organization-wide thinking, architectural coordination was complementarily approached from a bottom-up, local decision-maker's perspective (Winter 2014). Similar to stewardship theory (Davis et al. 1997), architectural thinking favors its success potential for coordination in behavioral means. According to Winter (2014) as well as Aier et al. (2015), architectural thinking targets the state

of mind of local decision-makers, who are aimed at applying collectivistic considerations in their decisions and hence guide IS investments beyond local utilities. Following the concept of architectural thinking, there is no reconsideration of the traditional, coordinated model of man, but rather is the practice of architectural coordination, that aims for a complementation by a collectivistic orientation in decision-making.

To conclude, the holistic approach of architectural guidance remains not solely a question of coordination. However, a holistic guidance can be catered complementarily by a collectivistic orientation among incorporated decision-makers (Ross and Quaadgras 2012; Winter 2014). To this end, stewardship theory can be justified by conceptualizing a model of man that does not elude traditional means of coordination, but complementarily emphasizes a collectivistic orientation in decision-making, following up recent aims of EAM research. In order to identify how to approach architectural coordination as a collectivistic orientation in decision-making, the next step sets out a literature review and collection of focus group data on motivation mechanisms that foster this orientation.

E.3 Methodology

E.3.1 Literature Review

Fostering stewardship's promoted orientation in decision-making, "motivation" is bound to a wide range of causes and means (Davis et al. 1997). For an identification of the phenomenon of interest, motivation mechanisms are scoped at the outset.

In stewardship theory (Davis et al. 1997), motivation is defined by psychological and situational mechanisms: psychological mechanisms craft a collectivistic orientation through an individuals' state of mind, for instance by *intrinsic causes* (motivation by the achievement of higher order needs), *identification* (motivation by the feeling of belonging), and *use of power* (motivation by recognition and status). Situational mechanisms draw on work-environmental factors that foster collectivistic behavior, such as the *philosophy of management* (motivation by involvement orientation), *culture* (motivation by the style of working), and the means of *power distance* (motivation by distributed leadership). Owing to this broad scope of motivation and the expected large number of articles in research dealing with particular mechanisms, the search was aimed at a broad coverage of the phenomenon of interest.

In order to identify motivation mechanisms, high-ranked peer-reviewed publications from the *AIS Senior Scholars' Basket of Journals* were used (*European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of the Association for Information Systems, Journal of Information Technology, Journal of Management Information Systems, Journal of Strategic Information Systems, MIS Quarterly*). In the first step, the term "motivation*" was applied as search-title in the EBSCOhost (EBSCO) and Web of Science (WoS) databases (39 hits in total). Due to the broadness of the topic, the search was refined by excluding those articles, which were either (a) exposed to a content other than motivation, or (b) misleading in terms of stewardship's definition of psychological and situational mechanisms. Articles were sequentially excluded by reading (a) titles, abstracts and keywords (26 exclusions) as well as (b) the rest of the text's body (10 additional exclusions). In addition to the term-specific search, a backward search was added (22 inclusions) (Webster and Watson 2002) to probe for further mechanisms in the cited references of the articles at hand. In total, 25 articles served for an identification and further exploration of motivation mechanisms.

All 25 articles, although not studying the context of architectural coordination, had a characteristic focus on individuals working towards collectivistic ends and/or the achievement of higher order needs, and therefore implied an analogue approach to the conceptualized model of man underlying this research. More prominently, the found articles focused the topics open source software development and programming. As suggested by Webster and Watson, findings were classified (Webster and Watson 2002). Following stewardship theory, the definitions of psychological and situational mechanisms were used for classifying the gathered motivation mechanisms.

E.3.2 Focus Group

Mechanisms that enable and support a collectivistic orientation among decision-makers have been explored in a two hours focus group session that took place in November 2015 in Zurich, Switzerland. Focus group was used as a valuable method for capturing data from communication and interaction (Krueger and Casey 2000; Tremblay et al. 2010b) of experienced practitioners. Due to the fact that architectural coordination was often discussed to fall short in practice, these focus group data were used to enrich the qualitative literature review findings from a practical perspective. The session was hosted within an established practitioner community, having present ten senior IS experts in enterprise architecture, IS project management and IS strategy from five large

banking institutes, headquartered in Switzerland, Germany and Austria. Banking institutes provided a valuable background, in which primarily size and complexity of an organization affect the guidance of local decisions towards organization-wide ends. Due to regulatory changes in the banking industry, the consideration of organization-wide ends in decision-making has been particularly reinforced over the past years, having challenged organizations not only on their local business, but also their IT side.

Two slots were conducted, both briefly introduced by the moderator. In the first slot, coordination was discussed as a means for achieving organization-wide ends. Guided by the moderator, the second slot was focused at deeper exploring those brought up mechanisms that referenced the scope of motivation (following stewardship's definition of psychological and situational mechanisms), and discussing their characteristics.

E.4 Results

Using stewardship theory, findings were classified into five groups of motivation mechanisms, defined here and concretely explored in the following subsections (Table 24).

The first group was *identification*, summarized by psychological mechanisms gratifying an individual with a sense of belonging to the collective. Similarly described by stewardship theory, identification maintains and strengthens an individual's feeling of belonging to the organization (Davis et al. 1997). *Management philosophy*, the second group, continued social identification from a work-environmental (rather than psychological) perspective. Mechanisms were characterized as supporting an individual's commitment towards his/her environment (Davis et al. 1997). The third group was *monetary mechanisms*, incentivizing collectivistic behavior through financial means. Although stewardship theory did not explicitly promote financial means as motivation mechanism, support was found in the theory's generic discussion on extrinsic reward mechanisms, which appeared justifiable to include monetary mechanisms for further explorations. Alike, the fourth group, *use of power*, focused the motivation of behavior through rewards, which were promoted by stewardship theory along the self-actualization of the decision-maker (Davis et al. 1997). Furthermore, working towards the achievement of collectivistic benefits can be a reward itself. Counting towards this cause-effect relation was the fifth group of the reviewed literature, *intrinsic causes*. A parallel was drawn by stewardship theory, shedding light on intrinsic motivation caused by "higher order needs" that are served by individuals (Davis et al. 1997).

E.4.1 Mechanisms in Literature

Identification. Research has discoursed organizational identification (e.g., Van Dick et al. 2006) as motivation mechanism, creating a "sense of belonging" (Spaeth et al. 2015). A collectivistic orientation is likewise fostered by an identification with established goals (Hars and Ou 2002). Motivation is further found as a result of socialization, a process that obligates an individual with the work-environment (Ke and Zhang 2010; Lakhani and Wolf 2003). Socialization is largely determined by cultural forces, such as norms, principles, and values, on the basis of which pursued activities become collectivistic-oriented (Lindenberg 2001). Deci and Ryan (1985) describe enjoyment of the work-environment as a cause for collectivistic behavior (Ke and Zhang 2010). Related to enjoyment (Lakhani and Wolf 2003) are inspiration (Li et al. 2012), acceptance (Venkatesh 2000), and the degree of creativity of the work-environment, which cause individuals' motivation for a collectivistic orientation (Amabile 1996). However, identification always depends on a subjective perception of the environment as well as the contributions made by collectivists to their surrounding environment. For example, instrumentality (perceived own contribution to the collective), self-efficacy (perceived capability of showing required actions for given tasks) (Hertel et al. 2003), and valence (subjective evaluation of goal dependencies) (Hertel et al. 2003) underline this dependency of identification.

Management philosophy. Management philosophy builds on support mechanisms that relate an individual's commitment towards his/her work-environment, and thereby strengthening a collectivistic orientation: for instance, Hertel et al. (2003) review trust and reliability as work-environmental factors that enable and support a collectivistic orientation. Such mechanisms craft a "psychological contract" between the individual and his/her work-environment, and further acts as motivation for further participation/commitment towards collectivistic ends (Choi et al. 2009). In this vein, credibility of the organization was found as commitment support factor (Newell and Goldsmith 2001; Spaeth et al. 2015). Kinship, often reviewed as "gift culture" (Von Krogh et al. 2012; Zeitlyn 2003), was also favored as motivation cause (Ke and Zhang 2010), a mechanism that enables collectivistic behavior, and simultaneously not expects a return on this behavior (contrary to the often discussed "reciprocity-based culture") (see Spaeth et al. 2015).

Monetary mechanisms. Monetary mechanisms received no explicit support from stewardship theory; evidence came from the reviewed literature. Some references compared

financial rewards with a form of control (Deci et al. 1999; Wiersma 1992), different to the conceptualized, non-economic model of man underlying this research. Contrary, other references heavily promoted financial means, some even considering a substituting ("crowding-out") effect of economic on non-economic means (e.g., Choi et al. 2009; Osterloh and Frey 2000): on the one side, literature outlined an indirect lens on economic means, i.e., low opportunity costs (Bonaccorsi and Rossi 2006). On the other side, literature discoursed the argument of direct financial benefits, rewards that foster the motivation for collectivistic behavior and that enhance the performance of the contributing individual (Bitzer et al. 2007; Hertel et al. 2003).

Use of power. In the group use of power, status-, career- and reputation-related aspects were discovered. As underlined by stewardship theory, this group of mechanisms focused the self-actualization of an individual (Davis et al. 1997): more prominently, the professional status and recognition of an individual play an important role in fostering a collectivistic orientation (Fershtman and Gandal 2007). The higher the expected recognition of an individual is, the greater the expectable contribution towards collectivistic objectives (Hars and Ou 2002). Mechanisms driving an individual's self-actualization followed examples of career advancements (Lakhani and Wolf 2003), experience gains (Ke and Zhang 2010; Ryan and Deci 2000), and reputation-building (Choi et al. 2009; Oreg and Nov 2008).

Intrinsic causes. Intrinsic causes explore the achievement of collective, including individual, benefits as motivation for a collectivistic orientation. Paradox, but although vast characteristics illustrate motivation as a means for achieving collectivistic benefits (e.g., Amabile 1996; Nakamura and Csikszentmihalyi 2003), evidence was gathered that working towards the achievement of collectivistic benefits comes back to a motivation mechanism in itself. Examples include organizational learning (Hillison 2006; Oreg and Nov 2008), skill training (Lakhani and Wolf 2003), and knowledge creation (Spaeth et al. 2015).

E.4.2 Mechanisms in Practice

The focus group session was briefly introduced by the moderator. In order to found a basis for mutual understanding on mechanisms applicable for architectural coordination, the participants of the session were asked to characterize purposes of their daily coordination practices in the meaning of achieving collectivistic rather than local benefits. As result, coordination was discussed as organization-wide means for balancing three areas

of conflict: global versus local optimization projects, sustainable/long-term investments (i.e., consistent architecture) versus short-term problem solving, and organization-wide goals/strategy versus individual/personal goals/interests. It was acknowledged that any form of mechanism applied for these coordination purposes highly depends on the cultural and work-environmental background of the respective organization as well as the mindset, sensations, and perceptions of its affected decision-makers.

Having discussed mechanisms of coordination, it was next probed by the moderator for additional information on those mechanisms that appeared highly referencing the scope of motivation (following the definition of stewardship theory). Consistent with the literature review, brought up causes and means were deeper discoursed, and finally classified to psychological as well as situational characteristics. In all, the mechanisms *identification*, *management philosophy*, *monetary mechanisms*, and *use of power* found evidence in focus group data. Culture was discussed in parallel as determining force on all other motivation mechanism. Notwithstanding their promotion by the reviewed literature, *intrinsic causes* found no explicit support from focus group data.

Throughout the workshop discussions, participants laid emphasis on mechanisms that tie decision-makers with their work-environment. Among the mentioned mechanisms (Table 24) was the *identification* with the social environment of the organization (e.g., culture, mindsets, personal ambitions). Furthermore, participants named situational mechanisms, such as the security of a decision-maker's job and work place, as well as the degree of co-management (*management philosophy*). Also affiliated to management philosophy was autonomy, explored as motivation mechanism for cooperative work-environments and collectivistic considerations in decision-making.

Finally, *monetary mechanisms* and the *use of power* found support from focus group data. Along monetary mechanisms, salary, bonus payments, and career benefits were named, rewarded, for instance, for project achievements that reach beyond a single or local solution. On the use of power, arguments were brought up that described organizational climate as enabling variable, i.e., conditions under which discussions and the participation in decision-making take place.

Motivation Mechanisms	Literature Review	Focus Group
Identification	Culture (norms, principles, values), enjoyment, inspiration, degree of creativity, acceptance	Culture, mindsets, personal ambitions

Management philosophy	Trust, reliability, credibility, kinship	Security of job and workplace, co-management, autonomy
Monetary mechanisms	Direct financial rewards, opportunity cost	Salary, bonus payments, career benefits
Use of power	Status, reputation, recognition, career and experience gains	Climate (discussions, participation in decision-making)
Intrinsic causes	Higher order needs (learning, training, knowledge)	---

Table 24: Results

E.5 Implications

Based on the explored groups of motivation, implications are raised on which ends the identified mechanisms may find theoretical substantiation for continuing architectural coordination complimentarily.

Identification. Identification was found largely determined by cultural forces. Prior EAM research has addressed the role of culture for impacting EAM's effectiveness (Aier 2014a). Likewise, stewardship theory promotes culture as a core motivation mechanism (Davis et al. 1997). Thus, future research may find support by an organizational culture theory lens for investigating organizations that process culture as a form of collectivistic alignment of their decision-makers (Schein 2010). Drawing on organizational culture theory, cultural artifacts may be used as lens for examining decision-makers' orientation towards the collective, including for instance an organization's espoused value or belief system (Aier 2014a; Schein 2010). Further relevant in the context of identification may be the decision-makers' perception of the work-environment as well as the perceived contributions to it. To this argument, organizational culture receives supported as a lens by stewardship theory, as any form of perception is manifested to underlying assumptions (i.e., perception, feelings) (Schein 2010) that may guide the integration of individuals towards collectivistic ends (Davis et al. 1997).

Management philosophy. Mechanisms of management philosophy continue identification from a work-environmental perspective. Shedding light on collectivistic considerations from an institutionalization perspective, EAM research (Weiss et al. 2013) has explored organizations as "a social order or pattern that has attained a certain state or property" (Jepperson 1991). Work-environments, particularly in terms of management philosophy, become institutionalized as social constructions with "a rule-like states of thoughts and actions" (Meyer and Rowan 1977). It may become relevant for future research to consider institutional theory as research lens in order to examine how local

decision-makers' orientation is fostered by their institutionalized environment on the one side, and how their behavior becomes reproduced in the organizational environment on the other side (Scott and Meyer 1991). First dedications have been made on using institutional theory as lens for investigating architectural coordination (Weiss et al. 2013), using similar mechanisms as considered by stewardship theory (Davis et al. 1997) and the literature review (Hertel et al. 2003), i.e., trust, reliability, social legitimacy or grounded values.

Monetary mechanisms and *use of power*. Following monetary mechanisms, collectivistic considerations can be fostered by financial means (Hertel et al. 2003; Spaeth et al. 2015), which contradicts the conceptualized model of a non-economic man. It was further noticed in the review of literature that economic mechanisms can have a substituting effect on non-economic mechanisms (Osterloh and Frey 2000), which questions their applicability in complementary ways. Regarding future EAM research in the vein of the proposed non-economic model of man, monetary mechanisms may hardly be continued. Other than that, the use of power justifies its existence by supporting the self-actualization of a decision-maker (Davis et al. 1997). Therefore, the use of power, for instance reputation- or status-related, may find a proper substantiation in future research, considering the lens of stewardship theory.

Intrinsic causes. Working towards higher order needs was discovered as a motivation mechanism in itself. This finding is thoroughly supported by stewardship theory in psychological mechanisms on the conceptualized model of man. Specifically, the theory states on intrinsic motivation that by working towards organizational, collectivistic ends, "personal needs are met" (Davis et al. 1997). Following this support, stewardship theory may substantiate future research lenses in approaching a collectivistic orientation in decision-making, complementary to traditional EAM approaches. Underlining this implication, the paper at hand exemplarily serves as an approach for guiding future research.

E.6 Conclusion

This research reports five groups of motivation mechanisms that set out a guidance for approaching architectural coordination through a collectivistic orientation in decision-making. These findings, not least due to their enrichment with focus group data, go beyond abstract conceptualizations, and substantiate the progress of complementary concepts in prospective EAM research.

However, this research has some limitations. First, stewardship's model of man is a complementary approach to the traditional, coordinated decision-maker. The impact of motivation mechanisms is therefore highly dependent on the shortcomings of traditional forms of architectural coordination, and limits a general applicability of motivation mechanisms in practice. Second, owing to the chosen search strategy, other substantially relevant literature work in the context of motivation might have been neglected, limiting further insights for instance into the coherence and reciprocity of motivation mechanisms on the one side, and their applicability to governance-based forms of coordination on the other side.

Future research, in approaching architectural thinking as an alternative means-ends approach to traditional forms of EAM-guided decision-making, may build on this research's substantiations: the implied theoretical lenses (e.g., institutional theory) may be used for shedding light on factors that determine the evolvement of non-governed forms of architectural guidance. Also, insights into action and behavior of decision-makers are supported, and how these become reflected and eventually reproduced over time (e.g., institutional theory, organizational culture theory). Finally, the interplay between organizational and decision-maker perspectives is supported, regarding stewardship theory's highlighted pertinence as research lens.

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Paper F – Enterprise Architecture Assimilation: An Institutional Perspective

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Abstract

Enterprise architecture (EA) has long been propagated in information systems research as an approach for guiding diverse local stakeholders toward a common holistic perspective. Despite its maturation over the past decades, organizations still encounter institutional obstacles with realizing EA's intended outcomes. Literature addressing this challenge mainly understands EA as an exogenous phenomenon that needs to be brought into the organization. In the paper at hand, we aim to go one step further. We focus on EA assimilation by studying the influence of institutional pressures that make EA part of the organization's worklife and thus contribute to EA's intended outcomes. By capturing all institutional pressures through which EA may become an inherent part of the organization's worklife, we empirically confirm their influence on EA assimilation and EA out-comes. In addition, we find the engagement of local organizational stakeholders to significantly mediate the relation between institutional pressures and EA assimilation.

Keywords

Enterprise architecture (EA), EA outcomes, EA assimilation, institutional pressures, local stakeholder engagement

F.1 Introduction

It is widely acknowledged that an organization's performance depends, among other factors, on the employed information systems (IS) that support its diverse business operations (Williams and Karahanna 2013). The larger the organization and the higher the diversity of its business operations, the more likely IS development budgets and project ownerships will be allocated to local business units. While local IS ownerships foster the alignment of IS development endeavors with local business needs, they often bring about the lack of IS efficiency and IS flexibility in dealing with cross-unit synergies and integration requirements (Peterson 2004). Hence, it has become vital for organizations to take an enterprise-wide perspective beyond local IS, considering the entire set of IS and their supported business operations, i.e. to take an *enterprise architecture* (EA) perspective. Taking an EA perspective helps organizations to guide the design and evolution of their entire set of IS to assure intended outcomes of IS efficiency and IS flexibility on an enterprise-wide level (Schmidt and Buxmann 2011).

After its inception in the late 1980s (Zachman 1987) and advancements over the past decades (Simon et al. 2013), EA is still considered a maturing discipline in the IS literature. Early studies mainly promoted a set of artifacts for EA representation and management, such as EA standards, principles, plans, methods, modeling techniques, and frameworks (Boh and Yellin 2006; Richardson et al. 1990; Zachman 1987). Later studies focused on EA's situational adoption in different organizational contexts (Aier 2014a; Haki et al. 2012; Schmidt and Buxmann 2011; Ylimäki and Halttunen 2006). Yet, organizations continued to encounter institutional obstacles with realizing EA's intended outcomes (Gardner et al. 2012; Löhe and Legner 2014). Notwithstanding research's contributions in recent years, existing studies preeminently focus on EA as an exogenous phenomenon that needs to be *brought into the organization*. Owing to EA's ambition of guiding local IS endeavors toward enterprise-wide objectives, we argue that EA needs to be considered as an inherent *part of the organization*, ingrained in local stakeholders' decisions and activities to unfold its intended outcomes.

Complementing prior research that focuses on *bringing EA into the organization*, the objective of this study is to explain *EA as a part of the organization*, which we refer to as *EA assimilation*. The concept of assimilation is rooted in the innovation assimilation

literature; it has been used to explain the extent to which innovation is "absorbed into the worklife of the firm" and demonstrates its usefulness (Swanson and Ramiller 2004, p. 558). In order to account for assimilation, our objective is to step beyond perspectives of EA representation and adoption toward its "full institutionalization" (Fichman 2001). As institutional pressures (i.e. coercive, normative, mimetic) capture the underlying mechanisms of assimilation (Mignerat and Rivard 2009), we focus on their influence through which EA becomes part of the organization's worklife and thus contributes to its intended outcomes. We seek to answer the following research question (RQ):

RQ: What is the influence of institutional pressures on EA assimilation and outcomes?

Building on the lens of institutional theory, assimilation research, and EA literature, we derive a research model for explaining the realization of intended EA outcomes through EA assimilation in an organization. Testing our model via a partial least squares approach to structural equation modeling, we demonstrate that institutional pressures are positively related to EA assimilation. In turn, we confirm EA assimilation to be positively related to EA outcomes. We find additional explanation on the relation between institutional pressures and EA assimilation through the engagement of local organizational stakeholders, which significantly mediates this relation.

The remainder is structured as follows: first, we lay out the state of research on the main concepts comprised by our research, i.e. EA, assimilation, institutional pressures, and the engagement of local stakeholders. Second, we derive the research model and its constitutive hypotheses. Finally, we present our results and conclude by a discussion of our insights as well as their implications for prospective research.

F.2 Conceptual Foundation

F.2.1 Enterprise Architecture

EA refers to a holistic perspective on the organization's entire set of IS and their supported business operations, reflecting integration and standardization requirements of the organization (Ross et al. 2006). Its main intended outcomes (*EA outcomes*) are IS efficiency and IS flexibility (Lange et al. 2016): efficiency relates to an organization's ability to support business operations with the required IS and minimized unnecessary redundancies (Schmidt and Buxmann 2011), while flexibility concerns an organization's ability to quickly adapt its IS to new or changing requirements (Tallon and Pinsonneault 2011).

Focusing on how to reach the intended EA outcomes, different research streams have emerged over the past decades. Research has started in the early 1980s with developing adequate representations of EA (*EA conceptualization*) and gained significant momentum in the late 2000s with the focus on *bringing EA into the organization* (Simon et al. 2013).

EA conceptualization. Early publications focused on the adequate representation of EA through various artifacts (Schönherr 2004). Prominent artifacts include frameworks, such as the Zachman Framework (Zachman 1987) or The Open Group Architecture Framework (The Open Group 2018), as well as modelling techniques (Jonkers et al. 2004). Since the late 2000s, research began shifting the focus from rather technical EA representations to more holistic conceptualizations that also include organizational aspects, such as business strategies or processes (Winter et al. 2014). Despite the growing and comprehensive body of sophisticated EA artifacts (e.g., models, frameworks, principles, plans), a key EA challenge remained, that is to tailor EA to fit specific organizational contexts (Peristeras and Tarabanis 2000).

Bringing EA into the organization. Bringing EA into the organization remains a challenge for organizations due to the variety and interdependencies of IS developments as well as their affected, local stakeholders (Boh and Yellin 2006). Therefore, the responsibility for managing EA becomes usually anchored at a higher hierarchical level in organizations, i.e. at the top management level for enforcing EA compliance of local IS change and development endeavors in a top-down fashion (Richardson et al. 1990). Despite the growing maturity of EA artifacts and management approaches, organizations continue to experience institutional obstacles with realizing EA's intended outcomes (Gardner et al. 2012; Löhe and Legner 2014). To address this challenge, EA scholars have employed a variety of perspectives, such as situational adaptation (Aier et al. 2008; Haki and Legner 2013a; Ylimäki and Halttunen 2006), organizational adoption (Haki et al. 2012), organizational culture (Aier 2014a; Faller et al. 2016), and organizational critical success factors (Schmidt and Buxmann 2011; Ylimäki 2006). Building on research's valuable contributions for *conceptualizing EA* and *bringing EA into the organization*, in the paper at hand, we aim to take the discourses in EA research one step further by focusing on the institutional influences that make EA *part of the organization*. Complementing prior research, we assume that EA may unfold its intended outcomes when being ingrained in local stakeholders' decisions and activities.

Making EA part of the organization. In order to explain EA as a part of the organization and its related outcomes, we focus on the assimilation of EA. The concept of assimilation has been favored in the IS literature for moving researchers' scope beyond adoption phases, helping scholars to explain the extent to which the phenomenon subject to assimilation is absorbed into the worklife of organizations (Swanson and Ramiller 2004). Consequently, we review the concept of assimilation in the following.

F.2.2 Assimilation

Assimilation refers to the extent, to which a new phenomenon, such as an idea, device system, or a method, demonstrates its usefulness as a part of the worklife of an organization (Swanson and Ramiller 2004). As such, the new phenomenon becomes woven into the fabric of an organization's work system, even as this work system undergoes changes over time (Swanson and Ramiller 2004). In the IS literature, assimilation has been captured through the constructs awareness, understanding, and use (Lewis et al. 2003; Liu et al. 2010; Purvis et al. 2001).

Awareness. To become an integral part of the organization's worklife, organizational stakeholders need to become aware of the new phenomenon (Armstrong and Sambamurthy 1999). Likewise, organizational stakeholders need to become aware of the new phenomenon's fit to their business (e.g., processes) and information technology (IT) environment (Armstrong and Sambamurthy 1999).

Understanding. While being aware, stakeholders often encounter significant challenges and doubts in valuing the enhancements of their work activities and decisions through the new phenomenon (Liang et al. 2004). Valuing hereby refers primarily to an understanding of costs and benefits to the organization for using the new phenomenon (Purvis et al. 2001). In order to make effective use of a new phenomenon, organizational stakeholders need to understand how to conduct (or eventually adjust) their work activities and decisions appropriately (Fichman and Kemerer 1997; Saga and Zmud 1994).

Use. Use builds on awareness and understanding, measuring how the new phenomenon spreads in the organization's work system. Hereby, the literature differentiates primarily breadth and depth of use. Breadth explains how broadly (e.g., coverage of organizational units) the new phenomenon is used (Purvis et al. 2001), while depth reflects on how extensively the new phenomenon is used (e.g., embedded in thoughts or moving even deeper into the culture of the organization) (Liang et al. 2007).

For explaining assimilation, scholars have studied the influence of institutional pressures (Mignerat and Rivard 2009). Institutional pressures capture the underlying mechanisms (e.g., rules, norms, values, assumptions, or beliefs) that make a new phenomenon part of the organizations' worklife (Dacin et al. 2002; Orlikowski and Robey 1991). Institutional pressures are highlighted by institutional theory, which has emerged as a powerful lens in IS research over the past decade (Mignerat and Rivard 2009). In the following, we review the concept of institutional pressures.

F.2.3 Institutional Pressures

Institutional pressures have been promoted by institutional theory as underlying mechanisms of assimilation (Mignerat and Rivard 2009). Theory conceptualizes organizations as social constructions that seek to gain legitimacy in their environment. To gain legitimacy, such as with a new phenomenon, organizations adhere to a web of institutional pressures that are prevailing in their environment (Orlikowski and Robey 1991; Scott 2013). Theory distinguishes three institutional pressures, namely *coercive*, *normative*, and *mimetic pressures* (DiMaggio and Powell 1983; Scott 2013).

Coercive pressures stem from rules and regulations that constrain organizational behavior. Ang and Cummings (1997), for example, studied the influence of federal regulations on the banking industry and found that these regulations exert substantial influence on the assimilation of IS outsourcing practices. *Normative* pressures cater an obligatory dimension into social life by shared norms, values, and standards among organizational counterparts. For instance, Liang et al. (2007) showed that industry standards provide binding norms to organizations and thus lead to an assimilation of ERP systems. *Mimetic* pressures stem from mimicking others' action or behavior that are perceived as successful. According to Tingling and Parent (2002), the assimilation of a technology results from managers mimicking other organizations—that successfully use this technology—even if contrary to objective evaluations of the technology by their own staff.

The main body of IS research uses institutional theory at the inter-organizational level of analysis, studying the influence of institutional pressures on the assimilation of a new phenomenon (e.g., novel IS outsourcing practice or ERP system) from one organization to another (Mignerat and Rivard 2009). Complementarily, a few studies have investigated assimilation at the intra-organizational level of analysis, focusing on institutional pressures that arise from entities within an organization and that thereby influence the behavior of organizational stakeholders (Liu et al. 2010). Stakeholders follow institutional pressures, such as rules, norms, values, or beliefs to gain legitimacy with the new

phenomenon in their environment, making it thus part of the organization's worklife (Liu et al. 2011). For this reason, stakeholder engagement may be well-suited for explaining the relation between institutional pressures and assimilation (Lewis et al. 2003).

F.2.4 Engagement of Local Stakeholders

Institutional theory suggests that the behavior of organizational stakeholders is significantly influenced by their surrounding institutional arrangement, which is composed by institutional pressures (Scott 2013). As stakeholders seek to gain legitimacy in their environment, they conform to their institutional arrangement and thus follow institutional pressures to make the new phenomenon part of their worklife.

In this regard, the engagement of local stakeholders plays an important role. Local stakeholders follow institutional pressures that are exerted by global (e.g., top management) and other local stakeholders, exploring if and how the new phenomenon fits or enhances their individual decisions and activities (Liu et al. 2010; 2011). This leads stakeholders to develop a greater awareness as well as a greater shared understanding of the phenomenon's value and benefit to the organization (Lewis et al. 2003). Consequently, stakeholders also understand how to adjust their specific work processes through the use of the new phenomenon appropriately (Chatterjee et al. 2002). Furthermore, stakeholders propagate knowledge, belief, and commitment, which support the breadth and depth of use of the phenomenon in their worklife (Liu et al. 2010). Following the existing IS institutional and IS assimilation research (Liang et al. 2007; Mignerat and Rivard 2009), we conclude the engagement of local stakeholders as a mediator on the relation between institutional pressures and assimilation, helping to better explain this relation.

F.3 Hypotheses Derivation

In order to study EA assimilation and its related EA outcomes, our research model considers the role of institutional pressures and the engagement of local stakeholders (Figure 12). For deriving hypotheses, we present the research model at a higher level of abstraction (Chin 1998; Lohmöller 1989). We differentiate four higher-order constructs to derive our hypotheses. The eight lower-order constructs are based on our conceptual foundation and reflect the higher-order constructs (Wilson and Henseler 2007).

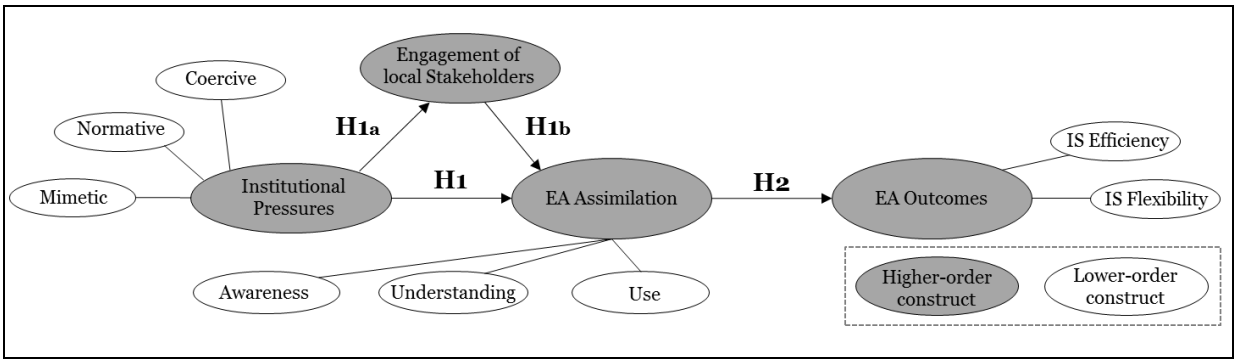

Figure 12: Research Model

We expect institutional pressures (reflected by coercive, normative, and mimetic pressures) to be positively related to EA assimilation (reflected by awareness, understanding, and use). The engagement of local stakeholders is expected to mediate the relation between institutional pressures and EA assimilation. Finally, EA assimilation is expected to be positively related to EA outcomes (reflected by IS efficiency and IS flexibility).

F.3.1 Enterprise Architecture Assimilation

In the EA context, coercive pressures are reflected primarily in architecture artifacts, such as plans, models, procedures, frameworks, standards, and principles (Aier et al. 2011; Haki and Legner 2013b; Richardson et al. 1990). Furthermore, boards and governance committees represent means to exercise architecture artifacts, to propagate EA value, as well as to enforce and sanction EA use (Boh and Yellin 2006; Boh et al. 2003; Lange et al. 2016; Schmidt and Buxmann 2011).

Normative pressures occur in the form of norms, values, and expectations. When not grounded in norms and values of the organizational work environment, it is unlikely that EA will develop a shared understanding of its value and benefits for the organization (Aier 2014). Consequently, EA is likely to lack recognition (Faller et al. 2016; Van Steenbergen 2011) and will thus remain only partially used (Niemi 2007; Op't Land and Proper 2007). Similarly, it is necessary that EA meets stakeholders' expectations. When deployed in line with stakeholders' expectations, EA will receive greater acceptance, and therefore, remains more broadly and extensively used in decisions and work activities (Tamm et al. 2011; Weiss et al. 2013).

Mimetic pressures are reflected in observation, communication, and imitation. These pressures are shown to foster an enhanced understanding of EA value as well as ultimately a greater EA use (Foorthuis et al. 2010; 2016). On the one side, communication

leads to a larger exchange of EA knowledge, experiences, learnings, and best practices (Abraham et al. 2015; Lankhorst 2005; Van Steenbergen and Brinkkemper 2009). On the other side, EA and its value propagate through stakeholders who observe and imitate their counterparts that are perceived as successful or legitimate when using EA (Brosius et al. 2016a; Weiss et al. 2013). By considering coercive, normative, and mimetic pressures, we assume that institutional pressures are positively related to EA assimilation:

H1: Institutional pressures are positively related to EA assimilation.

The engagement of local stakeholders helps to better explain the relation between institutional pressures and assimilation (Mignerat and Rivard 2009). In the EA context, local stakeholders refer to representatives of IT projects, involving personnel from the IT (e.g., software engineers) and business (e.g., business analysts) side (Boh and Yellin 2006). Furthermore, pressures reflect an institutional arrangement in the EA context, in which local stakeholders follow a web of EA rules, principles, norms, values, beliefs, and best practices that are propagated by top management, senior enterprise architects, or other local stakeholders (Aier 2014a; Boh and Yellin 2006; Brosius et al. 2016). Thereby, local stakeholders contribute to a greater awareness, understanding, and use of EA in their environment by being aware of enterprise-wide goals, understanding their value, as well as using them in their day-to-day decision-making (Boh and Yellin 2006; Boh et al. 2003; Tamm et al. 2011; Weiss et al. 2013). For this reason, we assume that the engagement of local stakeholders mediates the relation between institutional pressures and EA assimilation. We reflect this mediation via the following two hypotheses:

$H1_a$: Institutional pressures are positively related to the engagement of local stakeholders.

$H1_b$: The engagement of local stakeholders is positively related to EA assimilation, reflecting a mediation of the relation between institutional pressures and EA assimilation.

F.3.2 Enterprise Architecture Outcomes

Assimilation is captured by awareness, understanding, and use. In the EA context, most studies take a concerted view on EA outcomes, measuring both IS efficiency and IS flexibility (e.g., Brosius et al. 2016a; Lange et al. 2016; Schmidt and Buxmann 2011). In this regard, EA awareness, understanding, and use have been demonstrated to contribute to EA outcomes. For instance, awareness and understanding of EA are studied by Lange et al. (2016). They found both to be positively related to EA outcomes. Brosius et al. (2016) confirmed a positive relation between cooperative learning and EA outcomes. They investigated cooperative learning among stakeholders who share

knowledge and learn about the EA function, its intended value, as well as its benefits for the organization. Finally, Boh and Yellin (2006) focused on EA use, finding it positively related to EA outcomes. They understood use in terms of breadth (i.e. the number of key stakeholders using and conforming to EA) and depth (i.e. the extent to which EA standards are formally defined for different purposes). These findings lead us to assume that EA assimilation overall is positively related to EA outcomes:

H2: EA assimilation is positively related to EA outcomes.

F.4 Research Method

F.4.1 Construct Operationalization

To operationalize the constituent constructs of our research model, we adapt existing measurement items from the IS institutional, IS assimilation, and EA literature.

Institutional pressures are measured through 17 items. For all three pressures, we followed Liang et al. (2007) as an orientation. Due to different contexts (ERP assimilation on the inter-organizational level versus EA assimilation on the intra-organizational level), items could not be replicated. Instead, we translated Liang et al.'s (2007) construct operationalization into the EA context by using quantitative EA studies (Schmidt and Buxmann 2011; Weiss et al. 2013) to adapt the measurement items. We thereby modified the object of analysis, the entities exerting institutional pressures, as well as the level of analysis. We employed five items to measure coercive, six items to measure normative, and six items to measure mimetic pressures. For coercive pressures, we particularly consider the role of EA governance and artifacts (Schmidt and Buxmann 2011). For normative pressures, we differentiate the (peer) influence of IS project teams as well as project sponsors (regarding beliefs, support, and expectations) (Weiss et al. 2013). For mimetic pressures, we include the influence of perceived success and benefits among and within IS project teams as well as their project sponsors (Weiss et al. 2013).

EA assimilation is measured by 12 items. Assimilation is reflected in the institutional IS literature as awareness, understanding, and use. For awareness and understanding, we adopt four items each from Lange et al. (2016). For use, we followed Liang et al.'s (2007) differentiation of breadth and depth of use, translating both into the EA context by using Lange et al.'s (2016) quantitative EA study to adapt the measurement items.

Engagement of local stakeholders is measured via five items. Following the EA literature, we adapt EA stakeholder items from Schmidt and Buxmann (2011).

EA outcomes are measured through both enterprise-wide IS efficiency (five items) and IS flexibility (seven items). As these two variables are pre-dominantly promoted by the EA literature, we adopt all items from Schmidt and Buxmann (2011) (see also Brosius et al. 2016a; Lange et al. 2016).

We constitute a total of 46 items and measure them on a 5-point Likert scale. All constructs of our research model are measured in the reflective (rather than formative) mode.

F.4.2 Data Collection

The data collection took place between November 2017 and March 2018 by the means of a paper-based questionnaire as well as an online survey. In early November 2017, we conducted a pilot test in a workshop with 16 senior EA experts, aimed at probing face and content validity. For face validity, we tested the clarity, wording, and understandability of the formulated measurements items. In turn, for content validity, we ensured constructs' conceptual domain content, reflected by their measurement items. While all our constructs and their respective items are theory-driven and adapted from existing studies (see also construct operationalization), we evaluated in a discussion with the workshop participants the content captured by our measurement items. This helped us refining the final formulation of some of the measurement items, especially those reflecting institutional pressures, for data collection.

The paper-based questionnaire was distributed at three EA practitioner seminars in late November 2017. With 116 responses, we met an average response rate of 81%. Furthermore, we launched an online survey from December 2017 until March 2018, covering exactly the same items. We sent out the survey to 60 EA practitioners and collected 40 responses, having a response rate of 67%. While all paper-based surveys were filled out sufficiently (covering at least 50% of the measurement items excluding demographic questions), the online survey led to a reduced number of 18 responses due to 22 insufficient responses. In total, we collected 134 responses by the paper-based questionnaire and the online survey for further analysis. Missing values were treated by mean replacement (Hair Jr. et al. 2014).

In both the paper-based questionnaire and the online survey, we included six additional questions to ensure that our sample comprises a broad and sufficiently diverse participation, having respondents from different industries and organizations as well as with different functional and professional backgrounds.

The affiliated organizations of our respondents belong to various industries, namely financial services (20.2%), public administration (15.1%), information and communication (15.1%), manufacturing (12.6%), transport and logistics (10.9%), insurance (7.6%), utilities (5.9%), health care (5.9%), education (3.4%), as well as commerce/trade (3.4%). The represented organizations had an architecture function in place for an average of 8.97 years. Furthermore, the organizations had on average 21,051 employees, 2,810 of which (13.35%) belong to the IT function.

In total, 88.03% of the respondents reported to be affiliated primarily to IT units, 11.97% to business units. 77.12% indicated to work in a formal architect role. In their respective organizations, 12.2% reported to work on the local level (e.g., solution architect, project employee), 36.59% on the cross-unit level (e.g., domain architect, unit leader), and 51.22% to work on the enterprise-wide level (e.g., enterprise architect, executive management). On average, respondents worked for 8.67 years in their respective organization.

F.4.3 Data Analysis

For analyzing the collected data, we transformed the research model into a structural equation model (SEM), using a partial least square (PLS) approach to test our model. Compared to other linear regression models, the PLS-SEM approach allowed us to cope with the large number of measurement items reflecting (rather than forming) our constructs (Gefen et al. 2011). Compared to other covariance-based approaches, a PLS-SEM approach has soft distributional assumptions and modest sample size requirements (Chin 2010; Hair Jr. et al. 2014). We performed our analysis using the PLS implementation in SmartPLS, version 2.0.M3 (Ringle et al. 2005).

We evaluated the stability of the estimates by the bootstrapping resampling procedure with 5,000 resamples. Based on the resampling, significance levels were determined by the (two-tailed) *t*-value.

F.5 Results

F.5.1 Measurement Model and Validity Tests

Following the evaluation procedure by Hair Jr. et al. (2014), we assessed our measurement model for *indicator reliability*, *construct reliability*, *convergent validity*, and *discriminant validity*. Furthermore, we measured the model's *predictive accuracy, predictive validity*, and the *common method bias*.

Indicator reliability specifies the extent to which a measurement item's variance can be explained by the underlying construct. Usually, a factor loading of larger than 0.7 qualifies as reliable. From our model, eleven items were removed due to a loading of below 0.7, which simultaneously led to an increase of the convergent validity of their respective constructs (see Appendix E).

Construct reliability indicates whether items measure their construct adequately. It can be assessed via the composite reliability (CR) or Cronbach's alpha (CA), whereas for both criteria the values should exceed 0.6. In our case, both values lie far above the critical threshold with the lowest CR being 0.83 and the lowest CA being 0.7, thus indicating construct reliability (see Appendix F).

Convergent validity specifies to which extent a construct is explained by its measurement items and not by error. Typically, convergent validity is evaluated with the Average Variance Extracted (AVE) measure, favoring a value of at least 0.5, which indicates the explanation of a construct's variance of at least 50% by its constituent items. Except for the construct institutional pressures, all other constructs show a value higher than 0.5. After excluding four items on institutional pressures in the previous indicator reliability test (due to a factor loading of below 0.7), the AVE value rose slightly, however, remained finally at 0.44. According to Fornell and Larcker (1981), a value below 0.5 may still be acceptable under the condition that the CR value of this construct is higher than 0.6. Given the fact that for institutional pressures the CR shows a value of 0.91, this construct was not deleted from the model (see Appendix F).

Discriminant validity deals with the dissimilarity of constructs within a research model, which is especially necessary for the test of higher-order models (Gefen and Straub 2005; Hair Jr. et al. 2014), such as in our case. For testing the discriminant validity, we applied the Fornell-Larcker criterion, comparing the square roots of a construct's AVE with the other constructs' correlations. As the square root of each construct's AVE was greater than the highest correlation with any other construct, we found discriminant validity established (see Appendix G). Notably, in the case of higher-order models, the discriminant validity criterion does neither apply for comparisons between higher-order and lower-order constructs, nor between lower-order constructs (Hair Jr. et al. 2014).

A more sensitive approach for testing discriminant validity is the heterotrait-monotrait (HTMT) ratio of correlations (Henseler et al. 2015). The HTMT ratio reflects on the average item correlations across constructs relative to the item correlations within the same construct. A ratio below the value of 0.9 (HTMT .90) is acceptable for avoiding

potential lack of discriminant validity. Testing for the HTMT ratio in our research model, we found discriminant validity thoroughly established (see Appendix H).

Predictive accuracy is measured via the determination coefficient R^2, reflecting the share of an endogenous construct's variance explained by its constituent exogenous construct(s). Our resulted R^2 values explain 22% of stakeholder engagement, 50% of assimilation, and 21% of EA outcomes (Appendix F).

Predictive validity shows how well the empirical data can be reconstructed by using our model and PLS parameters. We tested for predictive validity by the non-parametric Stone-Geisser test (Geisser 1974; Stone 1974), using a blindfolding procedure with an omission distance of 7 (Hair Jr. et al. 2014). The resulting Q^2 values were all larger than zero, proofing established predictive validity (Appendix F).

Finally, we included *common method bias* as a supplemental analysis for PLS-SEM (Ringle et al. 2012) by conducting Harman's single-factor test. The test led to 36.21% of the variance explained, indicating that no single factor accounted for the majority of covariance among the measures (Podsakoff et al. 2003).

F.5.2 Testing of Hypotheses

As we ensured the validity and reliability of our measurement model, in the following, we provide our final structured equation model (Figure 13) to test our predefined hypotheses. The numbers next to the arrows and lines reflect the path coefficients as well as their corresponding significance level. The significance levels (***: a < 0.01; **: a < 0.05; *: a < 0.1) were based on two-tailed t-tests, calculated by a bootstrap procedure in SmartPLS with 5,000 samples (Hair Jr. et al. 2014). All constructs are shown with their corresponding determination coefficient (R^2). Building on this model, we present the tests of hypotheses in the following.

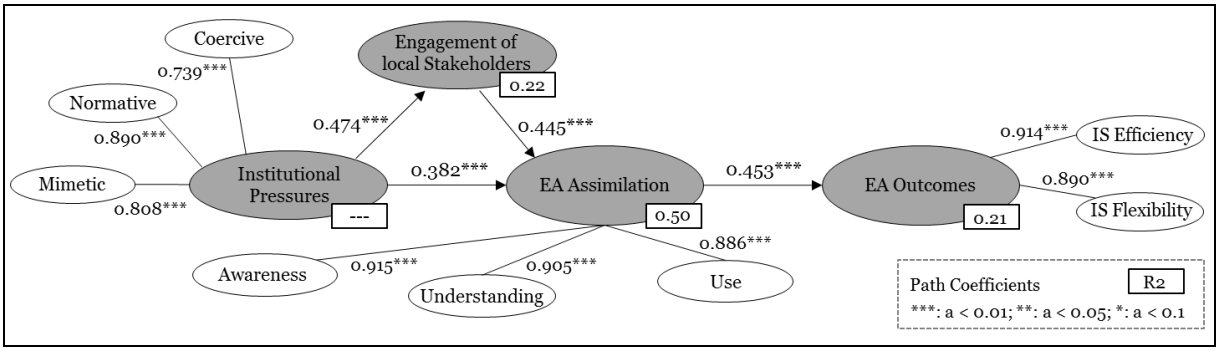

Figure 13: Research Model Results

Table 26 provides our tested hypotheses. Regarding institutional pressures and EA assimilation, we found a positive and significant relation, which supports H1. We also found a positive and significant relation between EA assimilation and EA outcomes, thus supporting H2.

Between institutional pressures and the engagement of local stakeholders as well as between the engagement of local stakeholders and EA assimilation, we found positive and significant relations, thus supporting $H1_a$ and $H1_b$. While both $H1_a$ and $H1_b$ reflect the important role of local stakeholder engagement, they also suggest a mediation effect on the relation between institutional pressures and EA assimilation.

In order to analyze whether the engagement of local stakeholders mediates the relation between institutional pressures and EA assimilation, we performed the Sobel test. We therewith tested whether the relation between institutional pressures (independent variable) and EA assimilation (dependent variable) is significantly reduced after the inclusion of the variable Engagement of Local Stakeholders. To perform the Sobel test, we used an online calculator, measuring the significance of the mediation by two-tailed probability values (Soper 2018). The test returned a two-tailed probability value of 3.804 (***: $a < 0.01$), thus supporting the mediation of stakeholder engagement on the relation between institutional pressures and EA assimilation as being significant.

Hypothesis	Path description	Path coefficient and significance	*t*-value (two-tailed)	Result
H1	Institutional Pressures → EA Assimilation	0.382***	4.778	Supported
$H1_a$	Institutional Pressures → Engagement of local Stakeholders	0.474***	5.656	Supported
$H1_b$	Engagement of local Stakeholders → EA Assimilation	0.445***	5.141	Supported
H2	EA Assimilation → EA Outcomes	0.453***	4.882	Supported

Table 26: Results

F.6 Discussion and Conclusion

As organizations continue to experience institutional obstacles with realizing the intended EA outcomes, we undertook this research to investigate EA assimilation, focusing on the influence of institutional pressures that make EA part of the organization's worklife. To provide an institutional account for EA assimilation, we argued that EA assimilation can be explained by institutional pressures through which EA becomes part of the organization's worklife. To this end, building on institutional theory, assimilation research, and the EA literature, we derived and empirically demonstrated the influence of institutional pressures on EA assimilation. We found EA assimilation to be positively related to EA outcomes. We also provided further analysis on the relation between institutional pressures and EA assimilation through the mediating role of the engagement of local stakeholders, which eventually provided a more elaborate explanation on how institutional pressures affect EA assimilation.

The use of institutional pressures helped us to look beyond isolated institutional mechanisms, such as coercive principles or standards, which are dominant in the EA literature (Boh and Yellin 2006; Richardson et al. 1990). Instead, we captured a concerted view on all institutional pressures that collectively explain EA assimilation in the organization. In combination, institutional pressures provide a microcosm of mutually interactive and interdependent rules, norms, values, and beliefs that make EA part of an organization's worklife and thus guide decisions and activities of local stakeholders toward EA outcomes. Next to predominantly promoted coercive pressures, we highlight the importance and role of normative and mimetic pressures in EA assimilation. In effect, building on the seminal notion of assimilation, we argue that EA assimilation can only be explained when normative and mimetic pressures are also considered. While acknowledging the role of coercive pressures, we demonstrate that EA can become part of an organization's worklife when being deployed in line with the organization's norms, values, and expectations (normative pressures). In addition, when expected outcomes of EA become somewhat visible in the organization, mimetic pressures force stakeholders to imitate organizational counterparts (e.g., peers) who benefited from EA. This mimicking behavior of organizational stakeholders leverages EA assimilation throughout the organization. Consequently, EA outcomes also depend on mimetic pressures that lead organizational stakeholders to become aware, understand, and use EA.

The engagement of local stakeholders, in turn, helped us to better explain the relation between institutional pressures and assimilation. In effect, local stakeholders adhere to

institutional pressures that are propagated through top management, enterprise architects, as well as other local stakeholders. In this regard, local stakeholders use and conform to EA in order to avoid sanctions, a conclusion that has mainly been captured through the influence of coercive pressures (Scott 2013). Furthermore, EA becomes part of the organization's worklife when stakeholders perceive EA in line with organizational norms, values, and expectations (see also Aier 2014). This conclusion largely stems from the influence of normative pressures (Scott 2013). Finally, when local stakeholders perceive their organizational counterparts (e.g., stakeholders from other local projects or organizational units) as successful in their IS endeavors due to EA, they model themselves on those organizational counterparts and start complying with EA (see also Brosius et al. 2016). This conclusion, at last, is based on the influence of mimetic pressures (Scott 2013).

F.6.1 Limitations

The realization of EA outcomes depends on the conceptualization of EA (e.g., adopted artifacts, extent of formalization, hierarchical level of exertion) (Aier et al. 2011). While focusing on EA assimilation, we do not consider the diversity of its conceptualizations. More generally, EA may be conceptualized in different levels of abstraction or detail, sophistication or simplification (Labusch and Winter 2013; Lankhorst 2005). This shapes the extent to which EA becomes understood and/or used by targeted stakeholders, especially by non-architects as well as by stakeholders outside the IT function (Gardner et al. 2012; Ross and Quaadgras 2012). In this vein, also EA outcomes depend on the conceptualization of EA. Hence, we motivate future EA assimilation research to consider more differentiated the conceptualizations of EA and how they relate or moderate EA assimilation as well as EA outcomes.

To explain the realization of EA outcomes, we studied the influence of institutional pressures on EA assimilation at the intra-organizational level of analysis. Consequently, we focused on entities within the organization, from which coercive (e.g., governance committees), normative (e.g., values among project sponsors), and mimetic (e.g., visible benefits of projects) pressures arise. However, we cannot claim to have controlled for all the pressures arising from outside the organization (e.g., regulatory requirements), which may have had an influence on our measurement of institutional pressures and EA assimilation within the organization. Future research can be advised to take this limitation into account when conducting institutional analyses at the intra-organizational level of analysis.

Finally, our research approach does not allow for longitudinal analyses. For EA awareness, understanding, and use, our study caters only a snapshot of assimilation. On the contrary, assimilation has been described as a continuous and enduring process that rises from initial awareness to the development of a shared understanding, and finally to use (Liang et al. 2004; Mignerat and Rivard 2009). While organizational stakeholders fluctuate, also work environments undergo several changes over time and therefore impose awareness, understanding, and use as a recursive process (Fichman 2000; Purvis et al. 2001). Also, the realization of EA outcomes is a continuous process that develops over time (Haki and Legner 2013a; Ross 2006b). While our design provides a conceptual base for dynamic analyses, we motivate a longitudinal perspective for future research to better explain EA assimilation as well as the realization of EA outcomes over time.

F.6.2 Implications

Our findings provide several implications. The first is a theoretical implication on the use of institutional theory as a research lens. To date, the main body of IS research uses institutional theory at the inter-organizational level of analysis, studying how the assimilation of a new phenomenon occurs from one organization to another (Mignerat and Rivard 2009). Our study complements prior research by empirically demonstrating the influence of pressures on assimilation arising from entities within the organization, i.e. at the intra-organizational level. Building on our approach, we motivate future research to use institutional theory on new entities of analysis within the organization for explaining assimilation and the influence of institutional pressures (see also calls from Dacin et al. 2002; Greenwood and Hinings 1996; Greenwood et al. 2008; Pache and Santos 2013). While this may open an avenue for certainly more than one new level of analysis within the organization (e.g., the local actor, group, domain, or department level), it may also motivate researchers to study the relations between different entities and levels within an organization for assimilation as well as the influence of institutional pressures.

Furthermore, our findings offer implications for prospective EA research. In order to foster assimilation, future research may focus on how to make effective use of institutional pressures for making EA part of the organization. While prior research has mainly focused on coercive pressures, such as EA principles and control means (Simon et al. 2013), our study captures also normative and mimetic pressures, through which shared conceptions of EA can be made and consequently how EA becomes part of the organization's worklife. To this end, future research may focus on the design of artifacts re-

lated to normative and mimetic pressures (e.g., materializations that support to externalize and share EA success stories or best practices) and respective interventions (e.g., formal or informal meetings to negotiate stakeholders' EA expectations, norms, values, or beliefs) to foster and purposefully guide EA assimilation.

In addition to the use of institutional pressures for making EA part of the organization, we also motivate future research to shed light more explicitly on stakeholders' responses toward institutional pressures. While our study follows the common assumption of stakeholders responding to institutional pressures in favor rather than against assimilation, stakeholder responses could also weaken or even inhibit the influence of institutional pressures on assimilation (Mignerat and Rivard 2009; Scott 2013). From an institutional perspective, such responses may be discovered in personal motives and the behavior of affected stakeholders, yielding responses of compromise, avoidance, defiance, or manipulation (Oliver 1991). Thus, we call future research to consider the influence of institutional pressures on EA assimilation with regards to the response of affected stakeholders (see also Aier and Weiss 2012b).

Equally important as for EA research are our implications for EA practice. More generally, organizations are shaped by coercive, normative, and mimetic pressures that are prevailing in their institutional environment (Scott 2013). Institutional pressures (such as existing rules, norms, values, or beliefs) may foster, weaken, or even inhibit managerial attempts to foster EA assimilation and thus the realization of EA outcomes. Consequently, EA management needs to understand how efforts to foster EA assimilation (such as conceptualized artifacts or management methods) may interact with the pervasive influence of institutional pressures (see also Lewis et al. 2003; Purvis et al. 2001). EA management may develop, for instance, appropriate assimilation strategies that involve the joint adaption of existing institutional pressures and EA (artifacts/management methods) in order to contribute to the realization of EA outcomes.

In addition, EA management needs to consider the engagement of targeted stakeholders toward EA assimilation. Their influence on assimilation rises as stakeholders develop an understanding of how EA outcomes may fit or enhance their respective decisions and activities. In consequence, they develop and orient their individual work activities toward EA outcomes, by which they make EA part of their worklife. While the main body of EA research promotes to enforce and control compliance with EA targets (e.g., Boh and Yellin 2006; Richardson et al. 1990), we motivate EA management to be less concerned with enforcing or controlling rather than empowering and supporting stakeholders to achieve EA's intended outcomes on their own. This may be realized, for example,

by granting more autonomy as well as more decision-making authority to local stakeholders. While the intended outcomes may not be attained and become visible instantaneously, EA management should rather be considered as an emerging, long-term effort that requires time in order to unfold its contributions to EA outcomes (Haki and Legner 2013a; Ross 2006b).

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Appendix A – Measurement Scales of Cooperative Learning

Construct		Measurement item	Ld.	*t*-val.
Explicitness	Exp1	Our organization values enactive liaisoning for cross-functional activities.	0.79	19.48
	Exp2	Our organization values forming teams for conducting experiments, and sharing results with other departments.	0.72	11.38
	Exp3	Our organization values developing and sharing new values and thoughts.	0.86	30.07
	Exp4	Our organization values sharing and trying to understand management visions through communications with fellows.	0.80	16.88
Tacitness	Tac1	Our organization values gathering information from different internal units/departments.	0.72	10.45
	Tac2	Our organization values sharing information with external stakeholders.	0.72	11.12
	Tac3	Our organization values engaging in dialogue with competitors.	0.68	9.04
	Tac4	Our organization values discussing new plans and future opportunities within the organization.	0.77	15.82
	Tac5	Our organization values creating a work environment that allows peers to understand the craftsmanship and expertise.	0.77	17.74
Interdependence	Intd1	In our teamwork, we make sure that everyone learns from each other.	0.59	6.46
	Intd2	In our teamwork, our job is not finished until every team member has finished his or her job.	0.59	5.16
	Intd3	In our teamwork, our performance evaluations depend in part on how much all team members learn.	0.49	4.16
	Intd4	In our teamwork, I make sure that all other team members learn.	0.64	7.35
	Intd5	In our teamwork, the work steps are divided up so that everyone has a part to contribute.	0.46	3.73
	Intd6	In our teamwork, we have to share work material in order to complete the project.	0.49	3.25
	Intd7	In our teamwork, everyone's ideas are needed if we are going to be working successfully.	0.66	8.61

	Intd8	In our teamwork, I am dependent on other team members' knowledge for completing my part of the project.	0.57	6.12
Interaction	Inta1	In our team, I like to share my ideas and work material with other members of the team.	0.74	6.52
	Inta2	In our team, I can learn important things from other team members.	0.82	14.68
	Inta3	In our team, I like to help my team members.	0.79	9.71
	Inta4	In our team, it is useful to help other team members learn.	0.74	12.25
	Inta5	In our team, I like to cooperate with my team members.	0.83	14.41
	Inta6	Members of our team learn a lot of important things from each other.	0.69	13.94
Evaluation	Eva1	In our team, we take time to examine areas in which we can deepen our skills and experience.	0.84	23.17
	Eva2	We rarely stop to consider how we can work better as a team.	0.87	29.78
	Eva3	We have recently discussed the strengths and weaknesses of our work on a particular project/job.	0.71	7.44
Project Effectiveness	Pefft1	The quality of the project deliverables in our organization is high.	0.91	46.89
	Pefft2	The projects in our organization meet the desired requirements.	0.90	41.45
	Pefft3	Project scopes can be changed effectively.	0.77	14.51
Project Efficiency	Peffc1	The projects in our organization meet their budgets.	0.70	9.04
	Peffc2	The projects in our organization meet their deadlines.	0.82	21.39
	Peffc3	The complexity of the projects in our organization are manageable.	0.59	6.13
	Peffc4	Project scopes can be changed efficiently.	0.71	10.26
Enterprise-wide Effectiveness	Ewefft1	The optimization of our organization’s information systems often leads to organization-wide (instead of local) benefits.	0.75	13.03
	Ewefft2	Our organization's information systems landscape supports the operational alignment of business and IT.	0.82	25.01
	Ewefft3	Our organization's information systems landscape effectively fosters communication across organizational units.	0.89	42.65

	Ewefft4	Our organization's information systems landscape supports the strategic alignment of business and IT.	0.86	26.62
	Ewefft5	Our organization's information systems landscape enables effective cooperation.	0.79	16.11
Enterprise-wide Efficiency	Eweffc1	Our organization's information systems fulfill business requirements.	0.58	5.57
	Eweffc2	Our organization's information systems follow set standards.	0.64	7.95
	Eweffc3	Our organization's information systems are consolidated enterprise-widely.	0.78	19.55
	Eweffc4	The complexity of our organization's information systems landscape is low.	0.51	4.61
	Eweffc5	The cost of our organization's information systems landscape are low.	0.68	8.93
	Eweffc6	Our organization's information systems landscape is cost-efficient.	0.79	17.19
	Eweffc7	Our organization's information systems landscape enables efficient cooperation.	0.78	16.11

Table 27: Measurement Items of Cooperative Learning (Brosius et al. 2016a)

Appendix B – Construct Statistics of Cooperative Learning

Con-struct Order	Construct	Con-struct-ID	Composite Reliability (CR)	Cronbach's Alpha (CA)	AVE	R Squared (R^2)	Q Squared (Q^2)
LOC	Explicitness	Exp	0.87	0.80	0.63	0.84	0.51
LOC	Tacitness	Tac	0.85	0.78	0.54	0.86	0.46
LOC	Interdepend-ence	Intd	0.79	0.69	0.32	0.71	0.23
LOC	Interaction	Inta	0.90	0.86	0.59	0.77	0.45
LOC	Evaluation	Eva	0.85	0.74	0.66	0.49	0.32
LOC	Project effectiveness	Pefft	0.90	0.83	0.74	0.83	0.46
LOC	Project efficiency	Peffc	0.80	0.67	0.50	0.80	0.25
LOC	Enterprise-wide effectiveness	Ewefft	0.91	0.88	0.68	0.83	0.55
LOC	Enterprise-wide efficiency	Eweffc	0.86	0.81	0.47	0.82	0.38
HOC	Knowledge acquisition	Ka	0.90	0.87	0.49	---	---
HOC	Cooperative learning	Cl	0.88	0.86	0.32	0.23	0.07
HOC	Project performance	Pp	0.87	0.82	0.50	0.06	0.03
HOC	Enterprise-wide performance	Ewp	0.91	0.89	0.46	0.27	0.12

Table 28: Overview of Constructs of Cooperative Learning (Brosius et al. 2016a)

Appendix C – Construct Correlations of Cooperative Learning

$\sqrt{AVE}$	Cl	Ewp	Ka	Pp
Cl	*0.57*			
Ewp	0.28	*0.68*		
Ka	0.48	0.44	*0.70*	
Pp	0.25	0.50	0.44	*0.71*

Table 29: Construct Correlations of Cooperative Learning (Brosius et al. 2016a)

Appendix D – Heterotrait-Monotrait Ratio of Cooperative Learning

	Cl	Ewp	Ka	Pp
Cl				
Ewp	0.35			
Ka	0.55	0.50		
Pp	0.31	0.59	0.53	

Table 30: Heterotrait-Monotrait Ratio of Cooperative Learning (Brosius et al. 2016a)

Appendix E – Measurement Scales of EA Assimilation

Construct		Measurement item	Ld.	*t*-val.
Coercive Pressures	Coe1	IT boards or governance committees enforce the adoption of enterprise-wide objectives.	0.82	22.51
	Coe2	There are well-defined procedures through which enterprise-wide objectives are enforced.	0.79	17.71
	Coe3	Local IT design decisions that violate enterprise-wide objectives are tracked and sanctioned consistently.	0.76	12.27
Normative Pressures	Nor1	Local IT project teams believe in the value of enterprise-wide objectives.	0.72	12.50
	Nor2	Local IT project teams actively promote the consideration of enterprise-wide objectives.	0.84	28.54
	Nor3	Local IT project teams expect the consideration of enterprise-wide objectives.	0.74	11.86
	Nor4	Project sponsors believe in the value of enterprise-wide objectives.	0.78	14.44
	Nor5	Project sponsors actively promote the consideration of enterprise-wide objectives.	0.79	19.28
	Nor6	Project sponsors expect the consideration of enterprise-wide objectives.	0.73	13.39
Mimetic Pressures	Mim1	The competitive work conditions within local IT project teams require the adoption of enterprise-wide objectives.	0.83	21.55
	Mim2	The competitive work environment around local IT project teams requires the adoption of enterprise-wide objectives.	0.84	20.42
	Mim3	Success of local IT projects that adopt enterprise-wide objectives is visible to others.	0.84	27.58
	Mim4	Benefits of local IT projects that adopt enterprise-wide objectives are visible to others.	0.85	27.64
Engagement of local Stakeholders	Sta1	Local IT project representatives participate in negotiating a common vision of target architectures.	0.80	14.10
	Sta2	Local IT project representatives participate in negotiating a strategy for the use of target architectures.	0.88	28.67
	Sta3	Local IT project representatives participate in establishing processes to monitor the conformity of their design decisions to architecture artifacts (e.g., target	0.83	21.22

		architectures, rules, procedures, standards, principles).		
	Sta4	Local IT project representatives participate in developing architecture artifacts (e.g., target architectures, rules, procedures, standards, principles).	0.82	17.86
Awareness	Awa1	Local IT project teams are aware of the importance of considering enterprise-wide objectives in their design decisions.	0.71	12.35
	Awa2	Local IT project teams are aware of architecture artifacts (e.g., target architectures, rules, procedures, standards, principles).	0.84	26.58
	Awa3	Local IT project teams are trained to consider enterprise-wide objectives in their design decisions.	0.84	25.99
	Awa4	Local IT project teams are trained to apply architecture artifacts (e.g., target architectures, rules, procedures, standards, principles).	0.84	26.82
Understanding	Und1	Local IT project teams have a common understanding of enterprise-wide objectives.	0.74	13.57
	Und2	Local IT project teams have a common understanding of architecture artifacts (e.g., target architectures, rules, procedures, standards, principles).	0.86	30.90
	Und3	Local IT project teams understand how to consider enterprise-wide objectives in their design decisions.	0.77	11.94
	Und4	Local IT project teams understand how to consider architecture artifacts (e.g., target architectures, rules, procedures, standards, principles).	0.82	21.73
Use	Use1	Enterprise-wide objectives are reflected in the objectives of local IT project teams.	0.81	16.11
	Use2	Enterprise-wide objectives are reflected in local IT design decisions.	0.85	22.10
	Use3	Enterprise-wide objectives are routinized in tasks and activities of local IT project teams.	0.86	28.25
	Use4	Architecture artifacts (e.g., target architectures, rules, procedures, standards, principles) are routinely applied in local IT design decisions.	0.77	16.92
IS Efficiency	Ise1	The IT systems of our organization are rather consolidated.	0.90	48.45
	Ise2	The IT systems of our organization have only little redundancies.	0.88	33.39

	Ise3	IT system components are rather standardized in our organization.	0.80	17.01
IS Flexibility	Isf1	A common view on our customer is available to any authorized user in our organization.	0.85	26.72
	Isf2	Interfaces are transparent and allow simple access to most applications.	0.77	13.31
	Isf3	The development of new applications is facilitated by existing, reusable application components.	0.80	14.51

Table 31: Measurement Scales of EA Assimilation (Brosius et al. 2018a)

Appendix F – Construct Statistics of EA Assimilation

Order	Construct	Construct-ID	CR	CA	AVE	R^2	Q^2
Lower	Coercive Pressures	Coe	0.83	0.70	0.62	0.55	0.33
Lower	Normative Pressures	Nor	0.90	0.86	0.59	0.79	0.47
Lower	Mimetic Pressures	Mim	0.91	0.86	0.71	0.65	0.47
Lower	Awareness	Awa	0.88	0.82	0.65	0.84	0.55
Lower	Understanding	Und	0.87	0.81	0.63	0.82	0.52
Lower	Use	Use	0.89	0.84	0.67	0.78	0.51
Lower	IS Efficiency	Ise	0.90	0.83	0.74	0.83	0.63
Lower	IS Flexibility	Isf	0.85	0.73	0.65	0.79	0.51
Higher	Institutional Pressures	Inp	0.91	0.9	0.44	---	---
Higher	Engagement of local Stakeholders	Lse	0.90	0.85	0.69	0.22	0.14
Higher	EA Assimilation	Asi	0.93	0.92	0.53	0.50	0.25

Table 32: Construct Statistics of EA Assimilation (Brosius et al. 2018a)

Appendix G – Construct Correlations of EA Assimilation

$\sqrt{AVE}$	Inp	Lse	Asi	Eao
Inp	*0.66*			
Lse	0.47	*0.83*		
Asi	0.59	0.63	*0.73*	
Eao	0.36	0.32	0.45	*0.75*

Table 33: Construct Correlations of EA Assimilation (Brosius et al. 2018a)

Appendix H – Heterotrait-Monotrait Ratio of EA Assimilation

	Inp	Lse	Asi	Eao
Inp				
Lse	0.54			
Asi	0.65	0.71		
Eao	0.51	0.38	0.51	

Table 34: Heterotrait-Monotrait Ratio of EA Assimilation (Brosius et al. 2018a)

Curriculum Vitae

Personal Information

Name	Maximilian Hartmut Brosius
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Education

2015-2019	University of St. Gallen, St. Gallen, Switzerland Doctor of Philosophy in Management
2018-2018	Brown University, Providence, United States of America Visiting Research Fellow (Ph.D.)
2013-2014	University of Augsburg, Augsburg, Germany Master of Science in Information-oriented Business Studies
2009-2013	University of Augsburg, Augsburg, Germany Bachelor of Science in Information-oriented Business Studies

Professional Experience

2015-2018	University of St. Gallen, Institute of Information Management, Chair of Prof. Dr. Robert Winter, Switzerland Research Assistant
2014-2015	Senacor Technologies, Ireland Intern
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