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Governing Value Creation in Digital Platform Ecosystems

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Preface

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I greatly benefitted from my colleagues' wisdom, ideas, and support. Discussions and paper sessions with Christoph, Andreas, Tobias, Michael, Veronika, David, Leonard, Kai, Barbara, Chris, Jörg, Sebastian and many others helped to move papers along and get new perspectives. WISSS social events and after-parties, Wiesn, conference trips, and even coffee breaks with you would always make the sometimes-tough PhD life better. A special mention goes to Christoph. You always had my back no matter how much work you had for yourself. The many trips to Berlin and Dresden would not have been the same without you (and your car).

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Finally, I am deeply grateful to my family: To my parents, who supported me throughout my whole journey in different roles such as proofreader, babysitter, or patient listener. To my sister Amelie, former PhD student/fellow sufferer, who always had ideas on how to navigate in the jungle of academia. To my wife Katharina, who amazed me during all this time. Not only did you come to terms with me rushing from deadline to deadline all while complaining to you (daily), you also excelled at your exams, began your career, and organized our new life as a family.

I dedicate this thesis to my son, Emil.

Munich, July 2019 Maximilian Schreieck

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Abstract

Problem Statement: Digital platforms have become ubiquitous. By creating large ecosystems of third-party developers, digital platforms represent a promising strategy in the digital age. After the success of digital platforms in business-to-consumer markets such as mobile phones or video games, companies from more and more industries establish digital platform ecosystems. For example, with the advance of sensor technology and connectivity, the industrial Internet of Things gains importance with many digital platforms being launched. For companies that establish digital platform ecosystems, it is crucial to understand how they can create value with a digital platform. Value creation covers co-creating value with third-party developers and capturing a share of that value. Platform owners apply platform governance to co-create and capture value. While knowledge on platform governance has been accumulated in IS research, a comprehensive understanding of how platform governance is linked to value co-creation and value capture is missing. In particular, challenges of traditional companies that shift toward a digital platform strategy are not represented in literature.

Research Design: To address this gap, we first reviewed IS literature on platform governance to integrate the status quo and derive avenues for future research. Based on these results, we conducted a series of seven qualitative case studies analyzing governance mechanisms for (1) value co-creation and value capture in general and for (2) traditional companies that shift toward a digital platform strategy. We mainly relied on grounded theory methodology to select and analyze our cases of digital platforms in an exploratory manner. In sum, we conducted 118 interviews across 7 organizations and collected comprehensive secondary data.

Results: With this thesis, we first clarify the constructs of a digital platform, its surrounding ecosystems as well as platform governance. By synthesizing insights from literature, we show that digital platform ecosystems need to be studied from both a technology- and a market-oriented perspective. Second, we empirically explored governance mechanisms for value co-creation and value capture. For example, we provide absorption, co-selling, and verticalization as mechanisms for value capture, which has remained understudied so far. Third, we derive insights on how traditional companies can successfully shift toward a digital platform strategy by (1) highlighting the capabilities they need to develop, (2) describing the role of customers as developers as crucial part of the ecosystem, and (3) deriving a multi-layer approach to platform governance.

Contribution: Our results contribute, first, to literature on platform governance. By considering the context of traditional companies, we provide a more nuanced understanding of platform governance that goes beyond the standard model of digital platform ecosystems. By considering verticalization, blurring roles, multi-layered structures, and open hardware and data layers, our insights are applicable to complex digital platform ecosystems that occur for example in the enterprise software industry or in the industrial Internet of things. Second, we bridge IS and management literature by better linking platform governance to value co-creation and capture and by contributing specific platform ecosystem capabilities to the ongoing discussion on the capabilities companies need to create value with digital platforms.

Limitations: This thesis underlies, amongst others, two main limitations: First, qualitative studies are prone to a researchers' bias as data is interpreted by the researcher. It is not possible to fully eliminate an influence of the researchers' personal view and perceptions. We applied constant comparison and data triangulation to account for that limitation. Second, it is inherent to case studies that the generalizability of results is limited, given the unique context of each case. We acknowledge this by engaging in context-sensitive theorizing and by discussing generalizability for each case study.

Future Research: Our thesis yields five starting points for future research: First, we uncovered a make or join decision that traditional companies face when deciding on the creation of a digital platform. It would be worthwhile to empirically study factors that support either the make or the join decision. Second, research from the third-party developers' perspective would complement our work as we conducted our studies mainly from the platform owner's perspective. Third, we think that the role of intellectual property in digital platform ecosystems needs to be better understood to inform decisions on capturing value through licensing or adopting open source technologies. Fourth, competition between digital platform ecosystems and the implications of market dominance need to be studied to inform not only platform owners' strategic actions but also regulatory decisions. Lastly, the societal value that digital platforms create beyond the value for its owner is an important issue for future research. For example, digital platforms are increasingly gaining traction in developing countries and could be helpful for economic development.

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List of Abbreviations

AIS	Association for Information Systems
AMCIS	Americas Conference on Information Systems
AOM	Academy of Management Annual Meeting
API	Application programming interface
AR	Action research
CEO	Chief executive officer
CON	Conference
CRM	Customer relationship management
CX	Customer experience
ECIS	European Conference on Information Systems
EJIS	European Journal of Information Systems
EM	Electronic Markets
ERP	Enterprise resource planning
fsQCA	Fuzzy-set qualitative comparative analysis
GTM	Grounded theory methodology
HICSS	Hawaii International Conference on System Sciences
HMD	HMD Praxis der Wirtschaftsinformatik
ICIS	International Conference on Information Systems
ICSOB	International Conference on Software Business
IoT	Internet of things
IP	Intellectual property
IS	Information systems
IT	Information technology
ITD	Information Technology for Development Journal
ITMC	IEEE/ICE International Technology Management Conference
JAIS	Journal of the Association for Information Systems
JIT	Journal of Information Technology
JNL	Journal
LR	Literature review
NGO	Non-governmental organization
MKWI	Multikonferenz Wirtschaftsinformatik
NR	Not ranked

P	Publication
PlatStrat	Platform Strategy Research Symposium
RQ	Research question
SDK	Software development kit
VHB	German Academic Association for Business Research
WI	Internationale Tagung Wirtschaftsinformatik
WP	Working paper

Part A

1 Introduction

> *"Enterprises are realizing that, in the Internet, growth is limited if you are not becoming a platform that links with other parts of the greater system and thereby allows you to scale."* (member of platform team at a banking company, I70)

This quote from one of the case studies embedded in this thesis illustrates the growing importance of digital platform ecosystems across industries. In this thesis, we aim to understand how companies can create value with digital platforms. Particularly, we analyze the role of platform governance for value creation in digital platform ecosystems and study how traditional companies[3] can benefit from a digital platform strategy.

1.1 Motivation

Digital platforms and their surrounding ecosystems of third-party applications have an increasing impact on our lives. Mobile application platforms such as Google Android with its Google Play Store or Apple's iOS with its App Store provide millions of applications created by third-party developers (Liu et al. 2014; Garg/Telang 2013; Manner 2014). The social media platform Facebook has gained success when allowing third-party applications such as games (Claussen et al. 2013) and video gaming consoles such as PlayStation or Xbox owe their success to third-party game developers (Cennamo et al. 2018).

We define a digital platform as "the extensible codebase of a software-based system that provides core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate." (Tiwana et al. 2010, 676). A digital platform ecosystem emerges on the platform when platform participants, that is, producers and consumers of third-party applications, interact to co-create value (Constantinides et al. 2018; Jacobides et al. 2018).

Following the success of digital platforms in consumer-oriented markets such as mobile phone applications or video games, companies across many industries have started to implement digital platforms (Parker et al. 2016; Johnson et al. 2018): Manufacturing companies create digital platforms to establish an ecosystem of digital services around their machines as for example machine tools manufacturer Trumpf with its digital platform spinoff Axoom (Pankow 2018); automotive manufacturers develop digital platforms to provide an ecosystem of applications as part of the in-car experience as for example BMW with its offering ConnectedDrive (BMW Group 2019); banking companies use digital platforms to engage with Fintechs as for example Deutsche Bank with its dbAPI ecosystem (Deutsche Bank 2018); insurance companies provide insurance as a service via digital platforms such as Allianz with its spinoff Syncier (Nolte et al. 2019); farming equipment manufactures use digital platforms to offer farmers an ecosystem of value-adding services such as John Deere with its platform MyJohnDeere (Perlman 2017); and traditional software vendors develop digital platforms to offer third-party applications as soft-

[3] With the term "traditional companies" we refer to companies that established a product-centric business model in the pre-Internet age. Typically, these companies face the challenge to undergo digital transformation to leverage the Internet's underlying digital technologies. Other terms used in literature are "big old companies" (Sebastian et al. 2017); "incumbents" (Fuentelsaz et al. 2015a), or "established companies" (Ross 2019).

ware as a service in addition to their own core offering, such as SAP with its SAP Cloud Platform (DSAG 2017). All these companies, across various industries, aim to provide more value to their customers by opening their digital platform to third-party developers. By bringing new ideas, niche competencies, and innovative capabilities into the ecosystem, third-party developers co-create value with platform owners—value that is then shared between them.

IS and management scholars have studied digital platforms and how they can foster value co-creation in digital platform ecosystems. At first, it became obvious that platforms are typically used to create two-sided markets, that is, a market that brings providers and customers together (Evans/Schmalensee 2008, 2007; Rochet/Tirole 2005, 2003a). In the case of digital platforms such as Apple's iOS, the Apple App Store brings together third-party developers and users of applications. Thus, digital platforms affect value creation: linear value chains—where a vendor creates a product or service together with suppliers to sell it to the customer—transform into value networks—where different actors engage in joint value creation for customers (Peppard/Rylander 2006).

Given the two-sidedness of platform-based markets, digital platforms trigger indirect (or cross-side) network effects (Parker/Van Alstyne 2005). The more customers use a digital platform, the more attractive it is for third-party developers to create an application for that platform. The more applications are available on a specific platform, the more attractive the platform is for customers. As a consequence of indirect network effects, digital platforms face a "chicken-egg-problem" at launch: a critical mass of third-party developers and users has to be onboarded quickly, otherwise those that onboarded will leave due to the lack of customers or offered services (Evans/Schmalensee 2010). IS research provides insights on how digital platforms can be launched successfully to trigger sustainable value creation (Schirrmacher et al. 2017; Evans/Schmalensee 2016; Parker et al. 2016).

To manage value co-creation in digital platform ecosystems during launch and afterwards, platform owners apply platform governance (Tiwana et al. 2010). Platform governance refers to the "partitioning of decision-making authority between platform owners and app developers, control mechanisms, and pricing and pie-sharing structures" (Tiwana 2014, 25) and is key to the success of digital platform ecosystems. Aspects of platform governance discussed in IS literature cover the question on how open a digital platform should be designed (Eisenmann et al. 2009; Ondrus et al. 2015; Benlian et al. 2015); what control mechanisms need to be applied to ensure sufficient quality on the platform (Ghazawneh/Henfridsson 2013; Goldbach/Benlian 2014, 2015a; Manner et al. 2013a); what boundary resources platform owners should provide to third-party developers (Eaton et al. 2015; Ghazawneh/Henfridsson 2010; Karhu et al. 2018); or how co-created value is shared between platform owner and third-party developers (Oh et al. 2015; Rietveld et al. 2016).

In sum, IS research has established a basic understanding of platform governance for value creation in digital platform ecosystems, building on work on platform-based markets. However, we experienced that the understanding was not sufficient and specific enough to address the challenges that traditional companies face when shifting toward a digital platform strategy. One the one hand, it has been shown that digital platforms are used across industries such as automotive, manufacturing, or financial services (Svahn et al. 2017; Sebastian et al. 2017) and that companies that apply a digital platform strategy tend to be more successful (Johnson et al. 2018). On the other hand, there are many examples of failed platform projects (Alstyne et al. 2016), such as GE's platform for the industrial Internet of Things (IoT) which GE is trying to sell off as part of its digital division (Edwards 2018). It remains unclear how companies can successfully apply platform governance for value creation, in particular when they shift a traditional, linear business strategy toward a digital platform strategy. We identify three reasons for this gap that we aim to address with this thesis.

First, the terms digital platform and digital platform ecosystems are understood differently across IS literature. This makes it difficult to know which findings—for example on platform governance—can be applied for what kind of digital platform in what context. Some scholars focus on the capability of digital platforms to act as a marketplace that brings together providers and consumers of services (Bresnahan/Greenstein 1999; Bakos/Katsamakas 2008). Others highlight the characteristics of digital platforms as an IT artefact such as a modular architecture and extensibility through complements (Cusumano 2010b; Karhu et al. 2018). Both perspectives have resulted in different implications for platform governance because the governance of a marketplace focuses on transactions whereas the governance of a platform as an IT artefact focuses on technical aspects. Providing a unified understanding of digital platforms and resulting digital platform ecosystems by building on previous research is thus an essential basis for this thesis and will help to derive insights on platform governance for traditional companies that shift toward a digital platform strategy.

Second, insights on platform governance rarely differentiate between value co-creation and value capture, the two basic elements of a platform owner's value creation with a digital platform. Platform governance can support value co-creation, that is, it can enable third-party developers to contribute innovative solutions to a digital platform ecosystem (Manner et al. 2013a; Tiwana et al. 2010). But platform governance can also be targeted at the platform owner's value capture, that is, at maximizing the value the platform owner can claim out of the overall value that is co-created with third-party developers (Tiwana et al. 2010; Oh et al. 2015). Governance mechanisms target at value co-creation or value capture might have impeding effects on each other. While Tiwana et al. (2010) considers both aspects as part of platform governance, few others do. In particular, interaction effects between governance mechanisms for either value co-creation or value capture have been largely overlooked so far. For platform owners in general and traditional companies that become platform owners in particular, it is crucial to understand how a digital platform ecosystem not only flourishes but also yields benefits for the platform owner.

Third, most IS research on digital platform focuses on cases in which the platform has already been successfully established—insights gained from such cases are only of limited help for traditional companies that try to establish a digital platform based on their existing business. Typical examples of the digital platforms studied in IS research cover Google Android with the Google Play Store (Förderer et al. 2018a; Liu et al. 2014; Tilson et al. 2012a), Apple iOS and the Apple App Store (Eaton et al. 2015; Förderer 2017; Li et al.), Facebook (Claussen et al. 2013; Hilkert et al. 2010), and video gaming platforms such as PlayStation or Xbox (Cenamor et al. 2013; Cennamo et al. 2018; Srinivasan/Venkatraman 2008). While some studies consider the challenges of launching digital platforms (Schirrmacher et al. 2017; Evans/Schmalensee 2016; Parker et al. 2016) in general, specific challenges of traditional companies are only considered in few studies, such as in Karimi et al.'s work on the newspaper industry (Karimi/Walter 2015). Issues such as interaction effects of the digital platform strategy with existing business, resistance of employees, or legacy IT have not been discussed so far, along with the question under which circumstances joining an existing digital platform ecosystem might be a better strategy than creating one.

1.2 Research Questions

Overall, we aim to improve our understanding on how companies govern digital platform ecosystems to create value. We thereby focus on traditional companies that shift toward a digital platform strategy, a challenge raised in recent literature (Sebastian et al. 2017) and experienced by us in practice. We will answer three research questions along this thesis:

RQ1: *What does literature contribute to our understanding of governing value creation in digital platform ecosystems?*

This research question entails a review of literature on digital platforms with a focus on platform governance and value creation. As the term digital platform has been interpreted differently, it is important to clarify our understanding of digital platforms and digital platform ecosystems. This will also help to link our findings to literature. This research question is the foundation for the subsequent research questions and answering the question helped us to provide theoretical background for the empirical studies conducted to answer the subsequent research questions.

RQ2: *What mechanisms do platform owners apply to govern value co-creation and value capture in digital platform ecosystems?*

Based on this research question we aim to empirically analyze how platform owners apply platform governance. While literature provides insights on platform governance mechanisms, we differentiate value co-creation and value capture as separate parts of value creation that need to be considered jointly. The results of this research question inform the third research question which focuses on traditional companies. Only by analyzing platform governance in general, we are able to discuss the specific situation of traditional companies.

RQ3: *How can traditional companies successfully shift toward a digital platform strategy?*

The third research question is motivated by our experiences across traditional industries in Germany, covering banking, automotive manufacturing, equipment and tooling manufacturing, and enterprise software. As part of their digital transformation, many companies from these industries aim to establish digital platform ecosystems. By empirically studying several of such cases, we can better understand the specific situation of traditional companies compared to those of already established owners of digital platforms such as Google or Apple.

With each of these three research questions we become more focused, following the hourglass model of reporting research findings (Bem 2003). After answering the research questions, we will summarize and discuss our findings in order to generalize from the specific findings on traditional companies to the broader literature on digital platforms.

1.3 Structure

This thesis consists of three parts. In Part A, we first introduce the problem statement, describe the research questions along with the structure of the thesis (Chapter 1). Then, we provide the conceptual background of this thesis, that is, the concepts of digital platform, platform ecosystem, value co-creation and platform governance (Chapter 2). Furthermore, we describe the research approach of this thesis, which is a qualitative approach relying mainly on case studies and grounded theory methodology (Chapter 3). Part B includes eight peer-reviewed publications[4]. In the first publication, we provide the foundations for subsequent work on platform governance by reviewing IS literature on platform ecosystems with a focus on design and governance (Chapter 4). Based on that, three publications focus on platform governance and its relation to value creation (Chapter 5-7). With four further publications, we dive into the challenges of traditional companies to adopt digital platforms and to establish platform ecosystems (Chapter 8-11). In part C, we first summarize the results from the publications presented in part B (Chapter 12), discuss our findings (Chapter 13), and provide limitations (Chapter 14), implications (Chapter 15), and issues for future research (Chapter 16). We summarize the structure of the thesis in Figure 1.

[4] Part B consists of *Part B1: Published Articles* and *Part B2: Working Papers (WP).*

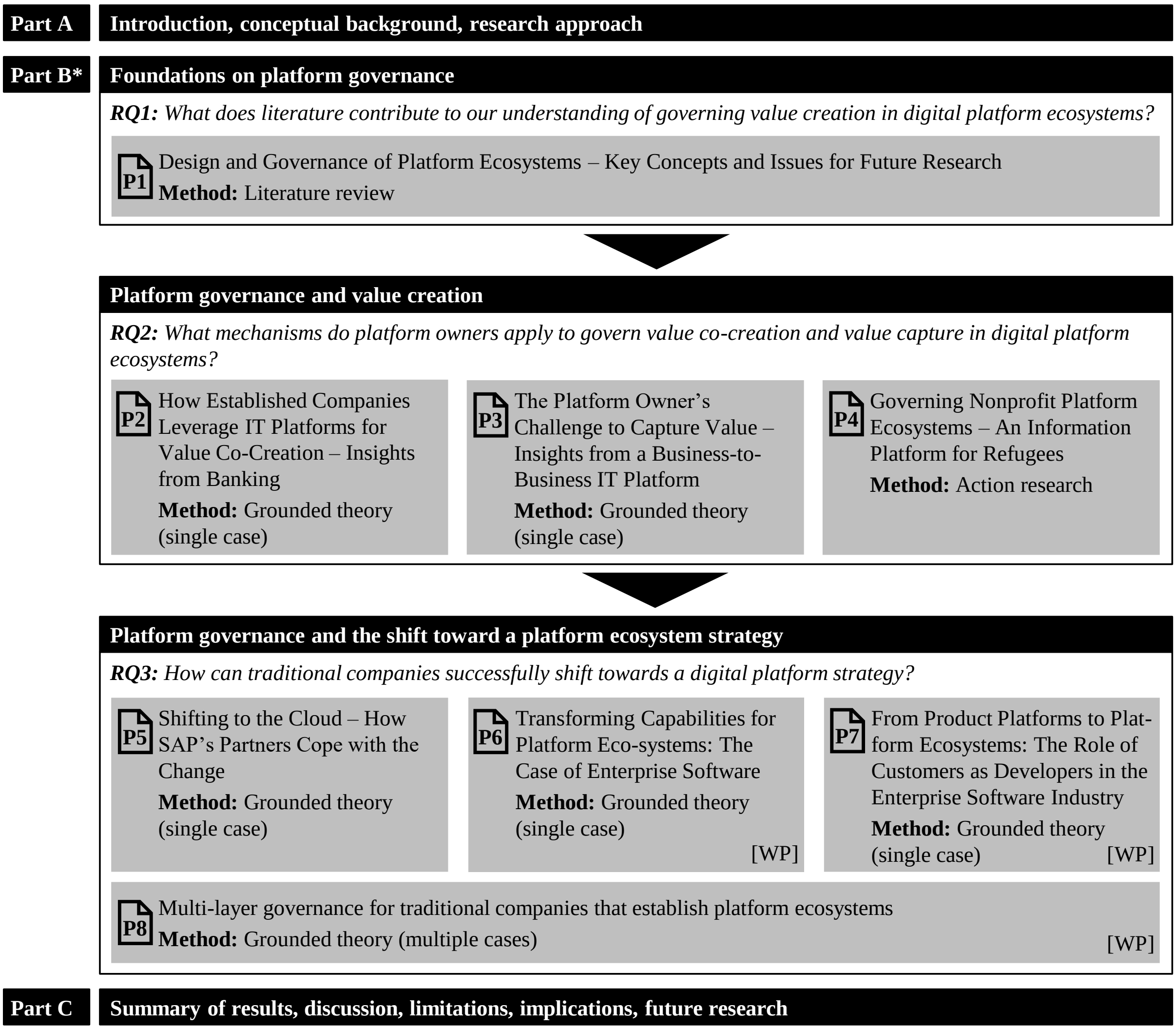

Figure 1. Structure of the Thesis
*Part B consists of *Part B1: Published Articles* and *Part B2: Working Papers (WP)*

In the following paragraphs and in Table 1, we summarize the eight publications that are embedded in part B. For each publication, we briefly outline the research problem, the methodological approach, and the main contributions of each publication (P).

P1: Design and Governance of Platform Ecosystems – Key Concepts and Issues for Future Research (Schreieck et al. 2016b). In this publication, we give an overview of current research in IS on the design and governance of platform ecosystems. We conducted a systematic literature review of IS research on digital platforms. We show that platform ecosystems have been analyzed from two different perspectives: technology- and market-oriented. Thereby, most studies take on the viewpoint of the platform owner. Furthermore, we summarize key concepts on the design and governance of platform ecosystems, namely, the definition of roles, pricing, boundary resources, and openness. Based on this analysis, we derive issues for future research: the integration of market- and technology-oriented perspectives, an individual level of analysis to include complementors and end-users and the role of data as boundary resource in platform ecosystems.

P2: How Established Companies Leverage IT Platforms for Value Co-Creation – Insights from Banking (Schreieck/Wiesche 2017). In this publication, we seek to improve our understanding of how established companies can co-create value through openness and collaboration with IT platforms. Based on an exploratory field study of a European bank that is introducing an IT platform, we show that openness and collaboration enable value co-creation while creating areas of conflict and potential benefit. For example, openness creates internal resistance and exposes technology while facilitating internal transparency and standardization. Collaboration entails conflicts with existing partners that are affected by the value co-creation strategy, but existing partners are also assets in incentivizing collaboration with third-party developers. Contributing to literature on value co-creation and openness of IT, we confirm that established companies can benefit from digital platforms but need to address specific conflicts and potential benefits related to balancing openness and control in the digital platform ecosystem.

P3: The Platform Owner's Challenge to Capture Value – Insights from a Business-to-Business IT Platform (Schreieck et al. 2017c). While substantial insights on value co-creation between the platform owner and complementors have been established, the platform owner's challenge to capture value remains largely unaddressed. In this publication, we, therefore, conduct an exploratory field study of an enterprise software vendor who has launched a business-to-business IT platform. We derive three distinct mechanisms of value capture: absorption, co-selling, and verticalization. We interpret how these mechanisms of value capture in turn affect value co-creation. With our results, we, first, enhance literature on value in IT platforms by adding mechanisms of value capture to the already established mechanisms of value co-creation. Second, we contribute to the discussion on the impact of digital business strategies on firm performance by showing that an organization that implements an IT platform needs to consider value co-creation and value capture jointly.

P4: Governing Nonprofit Platform Ecosystems – An Information Platform for Refugees (Schreieck et al. 2017b). In this publication, we aim to support a nonprofit digital information platform for refugees by developing a governance strategy for the ecosystem of information providers. Within an action research study based on a nonprofit project, we evaluate the implementation of governance mechanisms derived from platform and community governance literature. Our results show that governance mechanisms are implemented differently for nonprofit platform ecosystems than for commercial platform ecosystems. These results enhance the societal impact of the information platform developed in the project. The study contributes to theory on governance of platform ecosystems and IT-enabled collaboration by evaluating established governance mechanisms in the context of nonprofit platforms.

P5: Shifting to the Cloud – How SAP's Partners Cope with the Change (Schreieck et al. 2019). In this publication, we studied how the shift toward cloud-based software platforms affects ecosystem partners who have to adopt the new technologies, rethink their business model, and change their sales strategies. To understand how partners cope with this change, we conducted an exploratory case study within SAP's partner ecosystem after the introduction of a cloud-based software platform. We identify three distinct coping strategies that partners adopt in the face of the shift to the cloud. Partners either (1) embrace, (2) slow down, or (3) repurpose the change. SAP in turn engages in mediation actions to increase the adoption of its platform and to alleviate possible negative impacts of the coping strategies. These mediation actions contribute to a continuous adjustment of SAP platform ecosystem strategy. These findings contribute to literature on platform ecosystems by (1) highlighting that partners react differently to change in the ecosystem and by (2) shedding light on the interactions between platform owner and partners in the development of a digital platform strategy.

P6: Transforming Capabilities for Platform Ecosystems: The Case of Enterprise Software. In this study, we focus on the need of established companies to transform their organizational capabilities when shifting toward a digital platform strategy. While literature on platform ecosystems acknowledges this need, the process of transforming capabilities has not been studied in detail. Therefore, we conduct an exploratory case study of an enterprise software vendor that has successfully established a platform ecosystem. We show that the company transformed its capabilities through iterative changes to the capabilities' underlying routines. The iterative routine changes thereby were of (1) accelerating, (2) scaling, (3) deregulating, and (4) aligning nature. As a result, platform ecosystem capabilities such as eco-system management or platform evangelism emerge. Our findings enhance work on dynamic capabilities in the context of platform ecosystems by providing specific characteristics of the capability transformation process down to the level of routine changes.

P7: From Product Platforms to Platform Ecosystems: The Role of Customers as Developers in the Enterprise Software Industry. In this publication, we analyze the role of customers as developers when established software in the enterprise software industry are transformed into platform ecosystems. Until now, the transition from product platform to platform ecosystem, in particular in the context of enterprise software, has been understudied in the IS and management literature. We therefore conducted a multi-year, grounded theory study on SAP's transition from an ERP as product platform to a cloud-based platform ecosystem. Through the lens of platform governance, we show that platform owners should focus on customers as developers as the key actors in the ecosystem in the first phase of the transition. Once the installed base of customers as developers has grown, platform owners can direct the ecosystem toward a broader platform ecosystem by increasing the scalability of solutions initially developed for a specific customer.

P8: How Traditional Companies Establish Platform Ecosystems through Multi-Layer Governance – A Cross-Industry Study. In this publication, we study the challenge of traditional companies to establish platform ecosystems. These companies face a high degree of internal and external complexity such as heterogeneous product portfolios, fragmented markets, and existing partner networks. This complexity needs to be considered in the platform governance approach. IS research does not yet capture the complexity traditional companies face when creating platform ecosystems. Studies on platform governance mostly focus on "digital-native" companies that establish platforms on the green field. These results are of limited help for traditional companies that struggle to transform their existing business to a platform ecosystem. To address this gap, we conduct a multiple case study based on five traditional companies from different industries. We show that these companies apply governance on multiple ecosystem layers to manage the collaboration among (1) internal business units, (2) core partners, and (3) peripheral partners. Thereby, internal and external complexity affect the way companies govern these three stakeholder groups.

No.	Authors	Title	Outlet	Type
P1	Schreieck, Wiesche, Krcmar	Design and Governance of Platform Ecosystems – Key Concepts and Issues for Future Research	ECIS 2016	CON (VHB: B)
P2	Schreieck, Wiesche	How Established Companies Leverage IT Platforms for Value Co-Creation – Insights from Banking	ECIS 2017	CON (VHB: B)
P3	Schreieck, Wiesche, Krcmar	The Platform Owner's Challenge to Capture Value – Insights from a Business-to-Business IT Platform	ICIS 2017	CON (VHB: A)
P4	Schreieck, Wiesche, Krcmar	Governing Nonprofit Platform Ecosystems – An Information Platform for Refugees	ITD *(published 2017)*	JNL (NR)
P5	Schreieck, Wiesche, Kude, Krcmar	Shifting to the Cloud – How SAP's Partners Cope with the Change	HICSS 2019	CON (VHB: C)
P6	Schreieck, Wiesche, Krcmar	Transforming Capabilities for Platform Ecosystems: The Case of Enterprise Software	JIT *(under review, second round)*	JNL (VHB: A)
P7	Schreieck, Wiesche, Krcmar	From Product Platforms to Platform Ecosystems: The Role of Customers as Developers in the Enterprise Software Industry	JAIS *(revise and resubmit)*	JNL (VHB: A)
P8	Schreieck, Wiesche, Krcmar	How Traditional Companies Establish Platform Ecosystems through Multi-Layer Governance – A Cross-Industry Study	EJIS *(under review, second round)*	JNL (VHB: A)

Outlet:
ECIS: European Conference on Information Systems
ICIS: International Conference on Information Systems
ITD: Information Technology for Development Journal
HICSS: Hawaii International Conference on System Sciences
JIT: Journal of Information Technology
JAIS: Journal of the Association for Information Systems
EJIS: European Journal of Information Systems

Type:
CON: Conference
JNL: Journal
VHB: German Academic Association for Business Research
NR: Not ranked

Table 1. Overview on Embedded Publications

In addition to the eight publications embedded in this thesis, we conducted a number of additional studies that are related to the research question of this thesis (Table 2). These publications present additions to the issues discussed in the embedded publications, and many of them were led by other co- authors. Related to RQ1, we conducted a second structured literature review[5] where we applied bottom-up coding of concepts discussed in literature on digital platforms. We furthermore developed a conceptual paper on the definition of the term digital platform ecosystems[1]. Related to RQ2, we studied value co-creation and value capture from a theoretical viewpoint and empirically for business-to-business platforms[1], IoT platforms[6], platforms for urban transportation, and across several well-known digital platforms such as Google and Apple[1]. Related to RQ3, we analyzed further cases from the mobility services domain[1], the industrial IoT[7], and the automotive industry[8]. While these publications provide additional findings with regard to our research questions, we selected the publications embedded in this thesis (P1-P8) to provide comprehensive answers to our research questions.

[5] Led by Andreas Hein.
[6] Led by Christoph Hakes.
[7] Led by Louisa Schermuly.
[8] Led by Niklas Weiß.

Authors	Title	Outlet	Type	RQ
Hein*, Schreieck, Wiesche, Böhm, Krcmar	Organizing Digital Platform Research: A Complex Adaptive System Perspective	JIT *(under review)*	JNL (VHB: A)	RQ1
Hein*, Riasanow, Schreieck, Soto Setzke, Wiesche, Böhm, Krcmar	Digital Platform Ecosystems	EM *(major revisions)*	JNL (VHB: B)	RQ1
Schreieck*, Wiesche, Krcmar	Patterns of Value Capture in IT Platforms: Insights from the Enterprise Software Industry	JBE *(under review, second round)*	JNL (VHB: B)	RQ2
Hein*, Weking, Schreieck, Wiesche, Böhm, Krcmar	Value Co-Creation Practices in Business-to-Business Platform Ecosystems	EM *(published 2019)*	JNL (VHB: B)	RQ2
Schreieck*, Wiesche, Krcmar	Value Co-Creation and Value Capture in Digital Platforms	AOM 2019	CON (NR)	RQ2
Schreieck, Hakes*, Wiesche, Krcmar	Governing Platforms in the Internet of Things	ICSOB 2017	CON (NR)	RQ2
Schreieck*, Wiesche, Krcmar	Modularization of Digital Services for Urban Transportation	AMCIS 2016	CON (VHB: D)	RQ2
Hein*, Schreieck, Wiesche, Krcmar	Multiple-Case Analysis on Governance Mechanisms of Multi-Sided Platforms	MKWI 2016	CON (VHB: D)	RQ2
Hein*, Schreieck, Wiesche, Böhm, Krcmar	On the Genesis of Multi-Sided Platforms: Trajectories toward Mass Servitization	EM *(published 2019)*	JNL (VHB: B)	RQ3
Schermuly*, Schreieck, Wiesche, Krcmar	Developing an Industrial IoT Platform – Trade-off between Horizontal and Vertical Approaches	WI 2019	CON (VHB: C)	RQ3
Weiß*, Schreieck, Brand, Wiesche, Krcmar	Digitale Plattformen in der Automobilbranche – Herausforderungen und Handlungsempfehlungen	HMD *(published 2018)*	JNL (VHB: D)	RQ3
Weiß*, Schreieck, Wiesche, Krcmar	Setting Up a Platform Ecosystem - How to integrate app developer experience	ITMC 2018	CON (NR)	RQ3
Schreieck*, Wiesche, Krcmar	Multi-Layer Governance in Platform Ecosystems of Established Companies	AOM 2018 *(Best Paper Award 1st Runner-Up)*	CON (NR)	RQ3
Schreieck*, Wiesche, Krcmar	How Platform Governance Changes when Customers Become Developers	AOM 2019 *(nominated for Best Paper Award)*	CON (NR)	RQ3
Schreieck*, Clemons, Wiesche, Krcmar	Competing with Giant Platform Operators	PlatStrat 2019	CON (NR)	RQ3

* Lead author

Outlet:

JIT:	Journal of Information Technology
EM:	Electronic Markets
JBE:	Journal of Business Economics
AOM:	Academy of Management Annual Meeting
ICSOB:	International Conference on Software Business
AMCIS:	Americas Conference on Information Systems
MKWI:	Multikonferenz Wirtschaftsinformatik
WI:	International Tagung Wirtschaftsinformatik
HMD:	HMD Praxis der Wirtschaftsinformatik
ITMC:	IEEE/ICE International Technology Management Conference
PlatStrat:	Platform Strategy Research Symposium

Type:

CON:	Conference
JNL:	Journal
VHB:	German Academic Association for Business Research
NR:	Not ranked

Table 2. Further Publications, not Embedded in the Thesis

2 Conceptual Background

In this section, we shed light on the theoretical concepts that we build on in this thesis. We first clarify the terms digital platform and digital platform ecosystem. Then, we provide background on value creation—consisting of value co-creation and value capture—and platform governance.

2.1 Digital Platforms

The construct of a digital platform has different understandings and connotations in literature (De Reuver et al. 2018; Baldwin/Woodard 2009). With the aim to develop a more precise terminology, we first clarify the definition of digital platform as a construct of IS research and delimit the construct from related ones. Based on a structured literature review, we collected various definitions of digital platforms from high ranking IS and management journals as well as seminal books[9] (see Table 3).

To define the scope of our search and guide the exclusion of articles, we set three criteria for platforms that we do not see as part of digital platforms: First, we exclude purely physical product platforms, sometimes also referred to as product families (Thomas et al. 2014; Gawer 2014; Meyer/Lehnerd 1997) as for example car bodies in automotive manufacturing that serve as platforms for various car variants and even models. Second, we exclude digital infrastructure that sometimes is also termed digital platforms (Constantinides et al. 2018) as for example the Internet, data centers, and open standards such as IEEE 802.11, and USB (Constantinides et al. 2018). While digital infrastructure is the foundation for digital platforms, it is not sufficient to enable value creating interactions between actors. Third, we exclude platforms in the sense of an internal organizational structure (Ciborra 1996).

Author	Year	Term	Definition of platform
Bresnahan & Greenstein	1999	Computer platform	"A general mechanism to coordinate buyers' and sellers' efforts" (p. 3)
Fichman	2004	IT platform	"A general-purpose technology that enables a family of applications and related business opportunities" (p. 132)
Eisenmann et al.	2006	Platform	"Products and services that bring together groups of users in two-sided networks" (p. 2)
Bakos & Katsamakas	2008	Internet platform	"Platforms […] are two-sided networks. These networks have two types of participants ("sides"), where each side derives positive externalities from the participation of members on the other side in the network" (p. 171f.)
Gawer	2009	Industry platform	"A building block, providing an essential function to a technological system—which acts as a foundation upon which other firms can develop complementary products, technologies or services" (p. 2)
Baldwin & Woodard	2009	Platform	"A set of stable components that supports variety and evolvability in a system by constraining the linkages among the other components" (p. 19)

Table 3. Overview of Definitions of Terms Related to the Concept Digital Platform

[9] We first conducted a search with outlets from the Association for Information Systems (AIS) senior scholar's basket with the broader search term "platform". We then conducted an extensive forward and backward search in the databases Scopus, Web of Sciences, and EBSCOhost. The initial search comprised 72 relevant articles. We added a set of 58 papers resulting from the backward and 28 contributions from the forward search, totaling 158 relevant articles. Through the forward and backward search, management literature and seminal books were included in the sample.

Author	Year	Term	Definition of platform
Tiwana, Konsynski, Bush	2010	Software-based platform	"The extensible codebase of a software-based system that provides core functionality shared by the modules that interoperate with it, and the interfaces through which they interoperate" (p. 676)
Boudreau	2010	Technology platform	"Serving as a stable nexus or foundation, a platform can organize the technical development of interchangeable, complementary components and permit them to interact with one another" (p. 1851)
Cusumano	2010	Platform	"A foundation or base of common components around which a company might build a series of related products" (p. 32)
Evans & Schmalensee	2010	Two-sided platform businesses	"Platform businesses add value by facilitating interaction of various sorts between customers who are attracted to the platform at least in part by network externalities" (p. 1)
Yoo, Henfridsson & Lyytinen	2010	Digital product platform	"A digital product platform encompasses typically a particular range of layers (e.g., content and service layers) that can function as a new product, but simultaneously enable others to innovate upon using firm-controlled platform resources (e.g., SDKs [software development kits] and APIs [application programming interfaces])" (p. 729)
Evans	2012	Multi-sided platform	"Multi-sided platforms create value by helping two or more different types of users, who could benefit from getting together, find and interact with each other, and exchange value" (p. 1203)
Ceccagnoli et al.	2014	Digital platform/ IT platform	"IT platforms develop ecosystems and encourage third-party producers to develop complements—products that run on the platform" (p. 38)
Hagiu	2014	Multi-sided platform	"Multi-sided platforms are technologies, products or services that create value primarily by enabling direct interactions between two or more customer or participant groups" (p. 71)
Boudreau & Jeppesen	2015	Platform	"Multi-sided markets in which producers of complementary goods ('complementors') on one side compete to sell to users on the other side" (p. 1761)
Butler et al.	2015	Platform	"A platform is a passive agent that enables individuals to access messages from, and disseminates messages to, other members." (p. 8)
Eaton et al.	2015	Service system / mobile platform	"A service system is an interactive configuration of various resources and their mutual exchange to facilitate value cocreation that is institutionalized and regulated through institutional logics and standards" (p. 218)
Parker, Van Alstyne & Choudary	2016	Platform	"A business based on value-creating interactions between external producers and consumers" (p. 5)
Parker, van Alstyne, Jiang	2017	Platform	"A platform is a layered architecture of digital technology (Yoo et al. 2010) combined with a governance model" (p. 256)
Förderer et al.	2018	Platform	"A system that brings adopters of the system together with firms that provide complements to the system, so-called complementors, and focus in this paper on platforms that support uncoordinated and generative complementary innovation […]" (p. 445)
Karhu, Gustafsson, & Lyytinen	2018	Digital platform	"An extensible digital core that is opened for third parties to contribute improvements or add complements" (p. 479)
Huang, Tafti & Mithas	2018	Digital platform	"Virtual communities that extend beyond their boundaries to include various parties in their value ecosystems, such as customers who adopt their products and technologies, suppliers who provide component technologies, and partners who build complementary products and applications on top of their technology platforms" (p. 214)
Constantinides, Henfridsson, & Parker	2018	Digital platform	"Set of digital resources—including services and content—that enable value-creating interactions between external producers and consumers" (p. 381)

Table 3. Continued

Some of these definitions focus on specific characteristics of digital platforms. For example, several definitions highlight the role of digital platforms as enabler of transactions between two or more parties (e.g., Bresnahan/Greenstein 1999; Eisenmann et al. 2006) while others underline the platform's role as foundation for software applications (e.g., Tiwana et al. 2010; Ceccagnoli et al. 2014), or as foundation for online communities (e.g., Huang et al. 2018; Butler et al. 2014).

To provide an overarching definition that guides our further analysis, we rely on the broad definition "set of digital resources—including services and content—that enable value-creating interactions between external producers and consumers" (Constantinides et al. 2018, 381; see also Parker et al. 2016). This definition is sufficiently abstract to cover different interpretations of the digital platform construct and helps to delimit it from related constructs.

The overview of definitions includes a number of different terms for the digital platform construct. It is often referred to as IT platform (e.g., Fichman 2004), mobile platform in the context of smartphone operating systems (e.g., Eaton et al. 2015), multi-sided platform (e.g., Boudreau/Jeppesen 2015), community platforms (e.g., Butler et al. 2014) or just platform (e.g., Cusumano 2010b). Often the term platform ecosystem is used to refer to the digital platform along with all complements and stakeholders that are active on the platform (e.g., Tiwana et al. 2010). In this study, we refer to platform ecosystems as a group of stakeholders "having a common interest in the prosperity of a digital platform" (Ghazawneh/Henfridsson 2015, 200; cf. Selander et al. 2013) to clearly delimit the construct of digital platform from its ecosystem of stakeholders. The platform's central stakeholder is the platform owner, an individual or organization that represents the legal entity owning the platform (Tiwana 2014; Evans et al. 2006).

The different perspectives on digital platforms have an impact what researchers look at and what results they find, for example with regard to platform governance. Enabling transactions between unknown parties requires other governance measures than providing third-party developers with tools to contribute to a platform or than nurturing an online community. Thus, if researchers want to understand specific phenomena in the context of digital platforms, it proves helpful to break the abstract definition of digital platforms down into different types of digital platforms.

The fact that the digital platform construct is associated with different understandings has led to the emergence of typologies. On the one hand, some typologies delimit digital platforms from other types of platforms. On the other hand, some typologies have already established sub-types of digital platforms.

With regard to typologies that delimit digital platforms from others, the focus lies on the industry-wide impact of digital platforms. Other types of platforms are limited in their scope. Internal platforms shape the way organizations are structured internally as described in the typologies by Gawer (2014) and Thomas et al. (2014). Supply chain platforms go beyond one organization but connect a specific group pf organizations rather than being open to a whole industry (Thomas et al. 2014; Gawer 2014).

Typologies that break the digital platform construct down have mainly emerged in the last years as summarized in Figure 2. Building on these typologies, we constructed a meta-typology. The meta-typology includes three archetypes of digital platforms with digital infrastructure as a fourth archetype that we explicitly exclude (cf. Constantinides et al. 2018). The three archetypes we identified are exchange platforms, innovation platforms, and community platforms.

		Exchange platform		Innovation platform		Community platform	Digital infrastructure
Fichman	2004			Software development platform	Enterprise application platform		Infrastructure platform
Boudreau & Lakhani	2009	Two-sided platform	Integrator Platform	Product platform			
Tiwana	2014	Trading platforms		Software platform			
Thomas, Autio & Gann	2014	Market intermediary		Platform ecosystem			
Choudary	2015	Marketplace		Data platform		Community platform	Infrastructure platform
Evans & Gawer	2016	Transaction platforms		Innovation platform			
Reillier & Reillier	2017	Marketplace	Credit card and payment platform	Operating system		Social and content network	
de Reuver, Sorensen, Basole	2017	Payment platform	Peer-to-peer digital platform	Operating systems platform		Social media platform	
Song et al.	2017	Exchanges	Advertising-supported media	Transaction devices	Software platform		
Parker & Van Alstyne	2018	Matching system		Building block platform			

Figure 2. Overview Typologies of Digital Platforms

Exchange platforms “create value by helping two or more different types of users, who could benefit from getting together, find and interact with each other, and exchange value" (Evans 2012, 1203). Thus, the key for exchange platforms is intermediation, that is, facilitating transactions between different types of users (Rochet/Tirole 2003b; Armstrong 2006). Typically, the platform intermediates between two groups of users, often referred to as producers and consumers. **Innovation platforms** can be defined as “the extensible codebase of a software-based system that provides core functionality shared by the modules that interoperate with it, and the interfaces through which they interoperate”, following Tiwana et al. (2010, 675). On innovation platforms, complementors co-innovate products and services that are complementary to the platform, that is, they provide additional value to the users of the platform. The term **community platform** refers to “a passive agent that enables individuals to access messages from, and disseminates messages to, other members” (Butler et al. 2014). Community platforms bring together actors interested in a specific content that then become members of the community. The content within a community is mostly generated by the members. Members of the community can produce content and provide it on the platform or consume content that is already available.

These archetypes are often combined in a specific digital platform. For example, mobile phone platforms such as Google’s Android can be considered an innovation platform because it provides an IT artefact as basis for complementary applications. At the same time, the Google Play Store is a marketplace to organize transactions of these complementary applications between third-party developers and users, which could be seen as an exchange platform. The Android developer community is thereby a community platform that brings together third-party developers for example to solve problems or comment on new features.

For this thesis, our understanding is that a digital platform has to have characteristics of an innovation platform at its core. We thus rely on the definition by Tiwana et al. (2010, 675) of digital platforms as "the extensible codebase of a software-based system that provides core functionality shared by the modules that interoperate with it, and the interfaces through which they interoperate". At the same time, we acknowledge that digital platforms often also include characteristics of exchange platforms and community platforms.

2.2 Digital Platform Ecosystems

Digital platforms form the basis of platform ecosystems—the "group of stakeholders that has a common interest in the prosperity of a digital platform" (Ghazawneh/Henfridsson 2015, 200; cf. Selander et al. 2013). The term platform ecosystem came up in the IT industry in the early 2000's when Gartner referred to Microsoft's software products as a platform ecosystem (Smith 2001). IBM also used the term for the group of partners that engaged with its development platform to provide products complementary to IBM products:

> *"The IBM Software Development Platform ecosystem creates the **ecosystem effect**. This is a virtuous growth cycle in which, as more partners join the ecosystem and add value to the IBM Software Development Platform, the platform becomes richer and more valuable to both partners and customers—which in turn attracts even more partners and customers contributing to and gaining from the increasing value of the IBM Software Development Platform." (excerpt from an IBM report Stolinsky 2004)*

Cusumano/Gawer (2002) were among the first IS scholars to discuss the ecosystem that emerges around digital platforms, referring to it as the "innovation ecosystem" of a digital platform (p. 54). The term platform ecosystem became more popular with the tremendous success of mobile phone platforms such as Google's Android and Apple's iOS. In particular, seminal work by Tiwana et al. (2010), Gawer/Henderson (2007), and Eisenmann et al. (2011) led to a widespread adoption of the term in IS research and beyond. In parallel, the term ecosystem found wider use in the management literature as business ecosystems, as summarized by Kapoor (2018). The concept of ecosystems has been applied in strategic management to account for increasing importance of interorganizational relationships and activities (Adner 2017). As digital platforms enable interorganizational relationships and activities, we interpret digital platform ecosystems as a special form of business ecosystems in which a digital platform is the foundation for a business ecosystem. Some authors use the term software ecosystem to refer to groups of actors that create solutions complementary to a software system (Burkard et al. 2012; Jansen et al. 2009).

The term ecosystem is borrowed from biology and ecology (Table 4), where it refers to "physical and biological components of an environment considered in relation to each other as a unit" (Mens et al. 2014, 337). According to the analogy, platform ecosystems also include a group of different actors that are in relation to each other but function as a unit. In biological ecosystems, the main elements are the ecosystem's species that compete for resources but that also depend on each other. Only the interplay of different species allows for an ecosystem to be sustainable. Similarly, stakeholders in platform ecosystem such as third-party developers and the platform owner compete for the value created in the ecosystem but also depend on each other to create value in the first place. A biological ecosystem is embedded in an environment—its habitat—that includes for example soil, rocks, air, water, and light. A platform ecosystem is also embedded in an environment that includes software and hardware tools and platforms that the core digital platform interacts with or social media where ecosystem participants engage with their environment. In biological ecosystems, light is the primary source of energy because it fuels photosynthesis in plants, which are then consumed by other species. In platform ecosystem, the energy that fuels the ecosystem is the effort invested by stakeholders, typically financial investments. Ecosystems are dynamic: in biological ecosystems, relations within the food web lead to dynamics. In top-down food webs where predator-prey relationships prevail, dynamics are rooted in the proportion of the number of predators and prey in the ecosystem. In bottom-up food webs, dynamics are rooted in the availability of resources such as water. Similarly, platform ecosystems are dynamic and top-down or bottom-up governance impacts the dynamic in the ecosystem. Whereas one platform owner can define platform governance in top-down approaches (as for example Apple in its iOS platform ecosystem), in bottom-up approaches platform governance is developed by third-party developers in a self-organized, democratic way (as for example in open source projects).

	Ecosystem—Biology	**Ecosystem—IT**
Description	"Physical and biological components of an environment considered in relation to each other as a unit" (Mens et al. 2014, 337)	The "group of stakeholders that has a common interest in the prosperity of a digital platform" (Ghazawneh/Henfridsson 2015, 200; cf. Selander et al. 2013)
Elements	Different species	Stakeholders of the digital platform (developers, users, platform owners, …)
Environment	Habitat: soil, rocks, air, water, light, …	Software and hardware tools and platforms, social media, …
Energy source	Light	Effort invested by stakeholders
Dynamics	Food web: top-down (predator & pray), bottom-up (limited resource availability)	Interfirm network: top-down (one dominant keystone firm), bottom-up (e.g., open source consortium)

Table 4. The Ecosystem Analogy (adapted from Mens et al. 2014)

The analogy with biological ecosystems is helpful, because it shows that platform owners need to consider the ecosystem as a complex interplay of different actors when developing platform governance approaches. Only then, value creation will be sustainable and the platform ecosystem will be resilient to change. The comparison between biological and platform ecosystem is thus more than an analogy but provides the basis for theorizing on the ecosystem level.

However, the analogy also has limits which hinder direct application of ecosystem management findings from ecology to governance of platform ecosystems. A main issue is that in platform ecosystems, platform owners can set the rules how the ecosystem works and can quickly adapt them. In biological ecosystems, there is no authority that sets rules for the whole ecosystem. Instead, rules on collaboration and competition among species emerge over time and only change slowly as part of evolutionary mechanisms (Mens et al. 2014).

The goal of IS research on digital platform ecosystems has been to understand why some ecosystems flourish while others whither and what platform owners can do to create value with their platform ecosystem (Tiwana 2014; Tiwana et al. 2010). To analyze value creation in digital platform ecosystems, it is crucial to understand the interplay of internal factors that the platform owner can control such as platform architecture and platform governance and external factors rooted in the ecosystem's environment (Tiwana et al. 2010). In this thesis, we focus on platform governance and we consider external factors by taking into account the situation of traditional companies that shift toward a digital platform strategy.

In sum, the concept of digital platform ecosystems provides a framework for us to study how digital platforms form the basis for value creation among different actors. In some of the embedded publications we use the abbreviated version "platform ecosystem" instead of "digital platform ecosystem".

2.3 Value Co-Creation and Value Capture in Digital Platform Ecosystems

Digital platforms enable new business models (Brousseau/Penard 2007; Hackney et al. 2004). These platform-enabled business models leverage network effects (Brousseau/Penard 2007) as well as co-creation opportunities (Eisenmann et al. 2009) to create value for the platform owner. Digital platforms act as "value architecture" representing an opportunity to create value (Keen/Williams 2013). We therefore suggest to take on a value creation perspective to understand how firms can benefit from digital platforms.

Value creation is based on the transformation of inputs from suppliers into outputs for buyers. The outputs incorporate "added value" for buyers compared to the value of inputs (Brandenburger/Stuart 1996). In order to be successful, firms need not only to create added value for their buyers but also to capture parts of this value (Priem 2007; Lepak et al. 2007).

In today's hypercompetitive markets, the locus of value creation has shifted from the single firm to supply chains and, more recently, to interfirm networks that may be complex and fragmented (Bitran et al. 2007; Pagani 2013). In these interfirm networks, firms aim at cocreating value by aligning decisions, resources and activities with their network partners (Im/Rai 2014; Grover/Kohli 2012) and at capturing a sufficient share from the value that is cocreated within the interfirm network (Bharadwaj et al. 2013).

IT in general and digital platforms in particular affect the mechanisms of value creation and introduce new mechanisms (Chen et al. 2010; Rietveld et al. 2016). By encouraging co-creation with third parties, digital platforms exploit indirect network effects representing a new way to create value compared to the traditional way of processing inputs in-house (Ceccagnoli et al. 2012). As the cocreated value is shared among the actors of the platform, platform owners try to capture parts of the cocreated value. Value co-creation and value capture together constitute the value the digital platform creates from the platform owner's perspective (Huang et al. 2012).

While it is documented that value co-creation and value capture result in the value a platform owner gains from a digital platform, fragmented insights exist on how digital platforms enable value co-creation and value capture. According to these insights, boundary resources facilitate co-creation of value (Ghazawneh/Henfridsson 2013; Eaton et al. 2015), a balance of openness and control is required to optimize value co-creation (Boudreau 2010; Ghazawneh/Henfridsson 2013), and optimal pricing maximizes value capture (Lin et al. 2011). These insights explain separate aspects of value co-creation and value capture. An integration of the underlying mechanisms that explain value creation in digital platforms from a theoretical stance could significantly advance our understanding of digital platforms. The conceptualization of these underlying mechanisms and their simultaneous effect on value co-creation and value capture will contribute to a new conceptual model that substantiates platform-enabled business models (Yoo et al. 2010; Rai/Tang 2014).

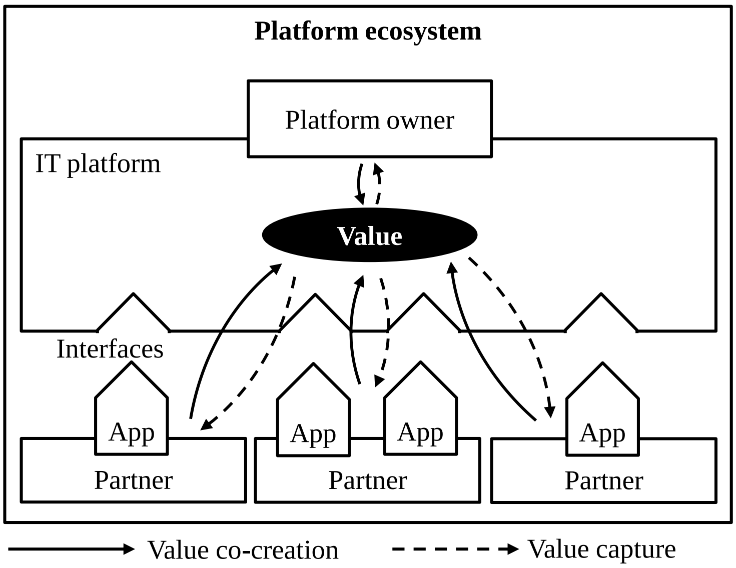

Figure 3. Value Co-Creation and Value Capture in Digital Platform Ecosystems

2.4 Platform Governance

To foster value co-creation and value capture in their digital platform ecosystems, platform owners engage in platform governance. We refer to platform governance as the "partitioning of decision-making authority between platform owners and app developers, control mechanisms, and pricing and pie-sharing structures", summarized as "who decides what" in a digital platform ecosystem (Tiwana 2014, 25; see also Manner et al. 2012).

Platform governance is thereby rooted in IT governance, which we briefly define below. With the emergence of IT, corporations had to "extend governance to IT and provide the leadership, organisational structures and processes that ensure that the enterprise's IT sustains and extends the enterprise's strategies and objectives" (IT Governance Institute 2003, 6). Drnevich/Croson (2012, 491) differentiate functional and strategic IT governance. While functional IT governance focuses on "implementation of large-scale projects and top-management oversight of major IT investments, policies, and technology choices", strategic IT governance "efficiently partitions activities, separating those that should be performed inside the firm from those that should be performed outside the firm". Other definitions follow either the functional view (Sambamurthy/Zmud 1999), the strategic view (Weill/Ross 2004; Schwarz/Hirschheim 2003), or a combination of both (Korac-Kakabadse/Kakabadse 2001). We provide a selective overview of the definition of IT governance in Table 5, an in-depth discussion on the term is provided by Schwertsik (2012).

Publication	Definition of IT governance
IT Governance Institute (2003, 6)	"IT governance is an integral part of enterprise governance and consists of the leadership and organisational structures and processes that ensure that the organisation's IT sustains and extends the organisation's strategies and objectives."
Drnevich/Croson (2012, 491)	Functional IT governance: "implementation of large-scale projects and top-management oversight of major IT investments, policies, and technology choices" Strategic IT governance: "efficiently partitions activities, separating those that should be performed inside the firm from those that should be performed outside the firm"
Weill/Ross (2004, 1)	"IT governance is the process by which firms align IT actions with their performance goals and assign accountability for those actions and their outcomes."
Sambamurthy/Zmud (1999, 261)	"IT governance arrangements refers to the patterns of authority for key IT activities in business firms, including IT infrastructure, IT use, and project management."
Korac-Kakabadse/Kakabadse (2001, 9)	"[…] IS/IT governance concentrates on the structure of relationships and processes to develop, direct and control IS/IT resources in order to achieve the enterprise's goals through value adding contributions, which account for balancing risk versus return over IS/IT resources and processes."
Schwarz/Hirschheim (2003, 131)	"[…] we have defined governance as the 'IT related structures or architectures (and associated authority pattern) implemented to successfully accomplish (IT imperative) activities in response to an enterprise's environmental and strategic imperatives'."

Table 5. Definition of IT Governance

Platform governance as special form of IT governance also includes functional and strategic aspects. Functional aspects relate to operational managing collaboration in digital platform ecosystems while strategic aspects relate to managing the way the digital platform changes value creation in the digital ecosystem. Thereby, platform governance comes down to finding the best solutions for several tradeoffs.

First, platform owners face a tradeoff between openness and control. Only through openness, external complementors can participate in digital platform ecosystems to generate additional, innovative solutions that create value for the customer (Ondrus et al. 2015; Benlian et al. 2015). But openness without limits can lead to low quality complements and even misuse of the platform for harmful purposes. Therefore, platform owners put control mechanisms into place to ensure that quality levels are maintained. These control mechanisms include formal control mechanisms such as app reviews or informal control mechanisms such as self control and clan control (Goldbach/Benlian 2014, 2015a, 2015b; Goldbach/Kemper 2014; Manner et al. 2013a).

Second, platform owners need to balance incentives granted for third-party developers with the value the platform owner can capture from the digital platform ecosystem. To incentivize third-party developers to join the digital platform ecosystem, platform owners offer to share the revenue that is generated through the third-party developers' products. Thus, a high revenue share for third-party developers increases incentives to join the ecosystem. But a high revenue share for third-party developers reduces the value the platform owner can capture from the digital platform ecosystem. To tilt the balance into their direction, platform owners have come up with further measures to incentivize third-party developers such as developer conferences, where third-party developers can engage with the community and new technologies (Förderer 2017) or gamification (Lusher 2013). But these measures require investments, reducing value capture. Thus, the basic tradeoff between incentivizing value co-creation and capturing value remains.

Third, platform owners need to balance standardized, ecosystem-wide and individualized, dyadic governance (Huber et al. 2017). On the one hand, platform owners aim to minimize costs for platform governance by standardizing governance approaches across the ecosystem of third-party developers. For example, boundary resources such as SDKs, blue prints, or documentation can be used by all third-party developers. On the other hand, providing individual support for specific third-party developers potentially yields more value co-creation (Huber et al. 2017). For example, the platform owner might offer consulting for important third-party developers to help them to create applications.

These tradeoffs show that platform governance is complex and that it is difficult to provide general guidelines on how to govern digital platform ecosystems to maximize value creation. The tradeoffs are interrelated, as for example a more open ecosystem might lead to higher costs for quality control and thus require a high degree of standardization in the boundary resources provided for third-party developers. It is crucial to consider the context in which digital platform ecosystems emerge to identify promising approaches to platform governance. Considering traditional companies that shift toward a digital platform strategy, different governance approaches might be required as the ones discussed in literature on well-established digital platforms such as Google Android or Apple iOS.

3 Research Approach

To study value creation in digital platform ecosystems, we take on an interpretivist stance and rely on a qualitative strategy of inquiry. In particular, we use action research and grounded theory methodology, which are both qualitative methods and can be used as part of an interpretivist epistemology (Villiers 2005). We applied context-sensitive theorizing to develop richer theories and provide guidance for practice (Hong et al. 2014; Weber 2003).

3.1 Interpretivist, Qualitative Research Strategy

To improve our understanding of value creation in digital platform ecosystems, we rely on an **interpretivist** epistemology, as opposed to a positivist, or critical epistemology (Orlikowski/Baroudi 1991). Underlying assumptions for interpretivist research include that reality is subjective, that is, people construct their reality based on their existing knowledge, view, and opinion (Guba/Lincoln 1994). To classify studies as interpretive, Orlikowski/Baroudi (1991, 5) refer to the criteria “evidence of a nondeterministic perspective where the intent of the research was to increase understanding of the phenomenon within cultural and contextual situations; where the phenomenon of interest was examined in its natural setting and from the perspective of the participants; and where researchers did not impose their outsiders' a priori understanding on the situation.” Interpretivist approaches aim at investigating interaction among individuals, technologies or organizations (Creswell 2013) and can yield “deep insights into information systems phenomena including the management of information systems and information systems development” (Klein/Myers 1999, 67). Opposed to an interpretivist epistemology, a positivist epistemology relates to research endeavors that aim at testing theory based on a priori assumptions of researchers, typically formulated as hypotheses (Orlikowski/Baroudi 1991). An interpretivist approach is suitable to study value creation in digital platform ecosystems because these ecosystems capture complex interactions of different organizations, which ultimately relate to interactions among humans. We comment on how our studies align with the principles for interpretive field studies suggested by Klein/Myers (1999) in Table 50 in Appendix A.

We applied a **qualitative** strategy of inquiry for our research. Qualitative research approaches are suitable to study complex phenomena that are often evolving dynamically (Strauss/Corbin 1990). Given the complexity and dynamic emergence, these phenomena are often rare or even unique, which makes it difficult to apply quantitative approaches. As summarized by Sarker et al. (2018), common qualitative methods cover grounded theory methodology, different types of case studies, and ethnography. In the studies included in this thesis we heavily rely on grounded theory as methodology of choice. The method we used pre-dominantly in the studies embedded in this thesis is grounded theory methodology which relies heavily on qualitative data. In sum, we collected interview data from 118 interviews across the different studies, along with comprehensive secondary data. More details on the interview data are provided in Appendix B.

3.2 Research Methods

Following an interpretivist paradigm in combination with a qualitative strategy of enquiry, grounded theory is the main method that we applied in six of the eight studies embedded in this thesis (P2, P3, P5-P8). In one study, the methodology we used is a systematic literature review (P1) and in another study we rely on action research because we were involved in the project that we studied (P4). While each publication includes detailed information about the methodology employed, we provide a brief background on each methodology in this section. In Table 6, we summarize which method we applied in which of the embedded publications. For grounded theory methodology, we differentiate partial and full application (Wiesche et al. 2017).

Publication	LR	AR	GTM (partial)	GTM (full)
Design and Governance of Platform Ecosystems – Key Concepts and Issues for Future Research (P1)	X			
How Established Companies Leverage IT Platforms for Value Co-Creation – Insights from Banking (P2)			X	
The Platform Owner's Challenge to Capture Value – Insights from a Business-to-Business IT Platform (P3)			X	
Governing Nonprofit Platform Ecosystems – An Information Platform for Refugees (P4)		X		
Shifting to the Cloud – How SAP's Partners Cope with the Change (P5)			X	
Transforming Capabilities for Platform Ecosystems: The Case of Enterprise Software (P6)				X
From Product Platforms to Platform Ecosystems: The Role of Customers as Developers in the Enterprise Software Industry (P7)				X
How Traditional Companies Establish Platform Ecosystems through Multi-Layer Governance – A Cross-Industry Study (P8)				X

Table 6. Overview of Research Methods Applied in the Embedded Publications (LR: literature review; AR: action research; GTM: grounded theory methodology)

3.2.1 Literature Review

Literature reviews provide the foundation for any research endeavor. Only by taking into account previous research, scholars are able to contribute to the scientific body of knowledge as they can relate new findings to the current state of knowledge (Iivari et al. 2004). Furthermore, literature reviews help to identify gaps and tensions in existing findings that can lead to valuable research questions. Thus, the goal of literature reviews is to synthesize literature on a specific topic, discuss central themes, and derive avenues for future research (Webster/Watson 2002).

While different approaches for literature reviews exist, systematic literature reviews provide the most comprehensive approach to reviewing as they strive for exhaustive coverage of relevant literature (Cooper 1988). Systematic literature reviews cover two main activities: identifying relevant articles and extracting findings from the set of relevant articles. Several scholars provide guidelines on how to conduct these activities (e.g., Webster/Watson 2002; vom Brocke et al. 2009). To achieve exhausting coverage, the process of identifying relevant articles covers several steps. The first step is a keyword search in databases that include the discipline's relevant journals and conference proceedings. This step is followed by a backward and forward search (Webster/Watson 2002). In backward search, researchers go through work that is cited by the articles identified in the first step to find additional articles that have been overlooked in the keyword search. In forward search, researchers go through work that cites the articles identified in the first step. Results from backward and forward search may also help researchers to identify additional keywords that can yield further results.

The second main activity in systematic literature reviews is the analysis of the collected articles to extract useful findings. (Webster/Watson 2002) recommend to follow a concept-centric approach rather than an author-centric approach when structuring results from literature. Instead of just listing what authors came up with what results, researchers should try to identify the most important concepts discussed across all articles. Typically, a concept matrix helps to summarize this analysis. Based on relationships between these concepts such as contradictions or different underlying assumptions, researchers can discuss avenues for future research.

In our study "Design and Governance of Platform Ecosystems – Key Concepts and Issues for Future Research" (P1), we systematically review literature on digital platform ecosystems to identify main concepts of platform governance and to discuss avenues for future research. This review served as basis for subsequent studies and helped us to link our findings to previous work on digital platform ecosystems.

3.2.2 Action Research

Based on the results of our literature review, we conducted several qualitative studies to develop a more nuanced understanding of platform governance and value creation. In one of these studies—"Governing Nonprofit Platform Ecosystems – An Information Platform for Refugees" (P4)—we applied the methodology of action research (Ziegler 2001; Susman et al. 2012). Action research is a special type of case study in which the researcher is actively involved in the phenomenon under study. It is suitable to study technology in its human context (Baskerville/Wood-Harper 1996) and it is appropriate if the researchers can have more impact by actively contributing to the project instead of just observing (Mathiassen 2002). Action research can be applied as part of a interpretivist epistemology (Villiers 2005).

Action research follows a cyclical approach (Ziegler 2001; Susman et al. 2012). After an initial step of **diagnosing** the problem at hand, researchers **plan their actions** to consider alternatives that address the problem. Researchers then **take these actions** and **evaluate** the impact of the actions. Lastly, **learning is specified** in order to start the next cycle based on the experiences made in the previous cycle (Figure 4). Davison et al. (2004) provide principles for action research that we considered for our action research study. These include the Principle of the Researcher–Client Agreement, the Principle of the Cyclical Process Model, the Principle of Theory, the Principle of Change through Action, and the Principle of Learning through Reflection.

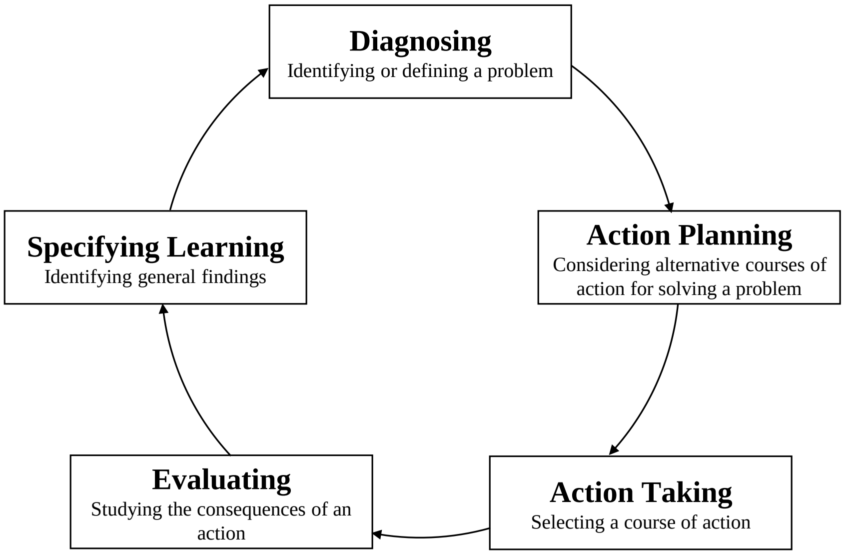

Figure 4. The Action Research Cycle (Ziegler 2001; Susman et al. 2012)

3.2.3 Grounded Theory Methodology

In six of the eight studies embedded in this thesis, we applied grounded theory methodology. Grounded theory methodology has been developed by Glaser/Strauss (1967) as method for the social sciences with the goal to develop theory from observations of interesting phenomena. Grounded theory methodology has been increasingly used in IS research (Seidel/Urquhart 2013) with scholars studying, for example, coordination in distributed software development teams (Espinosa et al. 2007), online collaboration behaviors (Gasson/Waters 2013), or IT consumerization (Gregory et al. 2018).

Two tenets coin grounded theory methodology: discovery and theoretical sensitivity (Glaser/Strauss 1967; Urquhart 2013; Wiesche et al. 2017). Discovery describes that the method is data-centric. ‘All is data’ is one of the keys to grounded theory methodology, which means that researchers engage in in-depth data collection for the phenomenon under study and an open-minded approach to data analysis. Thereby, researchers are not guided by an upfront theoretical framework that they seek to confirm, but they are open to concepts and relationships emerging from the data. This relates to the second tenet, theoretical sensitivity. While researchers that rely on grounded theory methodology need to be open to emerging concepts, they need to constantly go back and forth between literature and insights from the data to ensure that discoveries are of relevance for the field (Glaser 1978; Urquhart/Fernandez 2013).

Grounded theory methodology thus is an iterative approach in which data, that is, anecdotal evidence is coded with increasing degrees of abstractions to create a grounded theory (Figure 5). Different schools on how to conduct grounded theory methodology exist (Wiesche et al. 2017), in particular those building on Glaser and Strauss’ initial ideas (Glaser/Strauss 1967), those that follow either the Straussian (Strauss 1987; Strauss/Corbin 1990) or the Glaserian approach (Glaser 1978, 2005), two different approaches that the two founders developed independently of each other, or second generation approaches that have enhanced the initial methodology (Clarke 2005; Morse 2009). While the best way to analyze and code data is contested, coding data generally starts with an open coding phase. With subsequent coding steps, researchers categorize open codes and establish relationships between these categories. While (Strauss 1987) refers to these coding steps as open coding, axial coding, and selective coding, the Glaserian approach includes the steps of open coding, selective coding, and theoretical coding (Glaser 1978). Independent of the specific approach to coding, memoing is an essential tool that supports the coding process as researchers use memos to protocol ideas related to categories, relationships, and links to theory throughout the phase of data analysis (Glaser 1978; Wiesche et al. 2017).

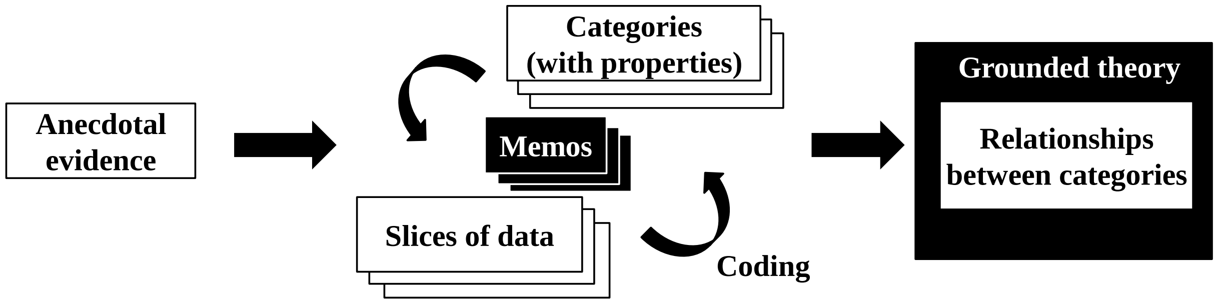

Figure 5. Grounded Theory Methodology (Urquhart/Fernandez 2013)

We apply grounded theory methodology in this thesis to develop an in-depth understanding of digital platform ecosystems. In particular when traditional companies try to establish digital platforms, these are complex endeavors that evolve dynamically overtime. An exploratory methodology such as grounded theory is thus suitable to capture this complexity. Thereby, grounded theory methodology is applicable from an interpretivist epistemology (Villiers 2005; Urquhart/Fernandez 2013). The degree to which we applied grounded theory methodology differs between the studies we embedded in this thesis. In the conference articles P2, P3, P5 we focus on providing a model as result of grounded theory with limited theorizing. This is a valid result because it provides the basis for further work that can go deeper with regard to theorizing (Wiesche et al. 2017). In these publications we therefore have rather used the term exploratory case study with regard to the methodology applied, but the approach of data collection and analysis is borrowed from grounded theory methodology.

In the journal publications P6, P7, and P8, we apply full grounded theory methodology and theorize on the capabilities required to establish digital platform ecosystems (P6), the role customers as developers play in digital ecosystems (P7), and the way platform governance changes when traditional companies establish digital platform ecosystems (P8).

3.3 Contextualization

Contextualization is an important aspect of our research approach because we think context is important to understand platform governance for value creation in digital platform ecosystems. Context can be referred to as “situational opportunities and constraints that affect the occurrence and meaning of organizational behavior as well as functional relationships between variables.” (Johns 2006, 386). Contextualization in management and IS research refers to conducting research and developing theory in a context-sensitive way (Hong et al. 2014; Whetten et al. 2009). Contextualization is helpful to “generate insights about the phenomena associated with information technologies (IT), individuals, and organizations" with the goal to develop richer theories and guidance for practice (Hong et al. 2014, 112; Weber 2003). For example, the impact IT has on the organizational forms that develop within an industry is dependent on characteristics of this very industry (Sahaym et al. 2007). Such findings suggest that also the impact of digital platforms on companies needs to be studied in a context-sensitive way, for example ba considering characteristics of the industry under study.

According to Hong et al. (2014) two types of contextualization approaches can be used: single-context theory contextualization and cross-context theory replication. In singe-context theory contextualization, established theories are contextualized by adding or removing core constructs. We apply single-context theory contextualization in several of our case studies by contextualizing established theories on digital platform ecosystems. For example, we enhance theory on platform governance mechanisms by considering the context of the enterprise software industry for digital platform ecosystems (see P4 and P8). In cross-context theory replication theories from different contexts are applied for the phenomenon of interest. We apply cross-context theory replication to replicate findings from management researchers on dynamic capabilities (Teece/Pisano 1994) and capability reconfiguration (Lavie 2006a) in the context of digital platform ecosystems (see P6).

With this thesis, we do not strive for a universal theory on value creation in digital platform ecosystems. Instead, we develop building blocks of context-sensitive theorizing that jointly improve our understanding of the phenomenon. By considering what characteristics of the context we study can be found in other settings, we discuss generalizability of our findings. We build on prescriptions by Davison/Martinsons (2016) for context-sensitive theorizing as summarized in Table 7.

Prescription by Davison/Martinsons (2016, 246-247)	Our implementation of the prescription
"The aims and context should fit with [the researchers'] personal strengths and the environmental opportunities."	The aim to understand how traditional companies can govern value creation with digital platforms aligns to the author's interest and experience in traditional industries. Furthermore, the Chair for Information Systems has vast experience with and access to digital transformation cases in traditional German industries.
"The context for a study should be chosen based on the specific aims and objectives of the research rather than convenience."	We purposefully selected contexts that differ from the common contexts in literature on digital platform ecosystems. For example, the digital platforms we chose to study are not situated in business-to-consumer markets but in more complex business-to-business markets.
"[Researchers should] avoid simplistic designs that test a few variables in a highly controlled context. Cultural and institutional constraints should be considered as part of the research design process."	We applied grounded theory methodology. Thus, we do not conduct our research in controlled settings but in the real-world context. By engaging in depth with the phenomenon, we consider institutional constraints and get access to personal views of our interview partners.

Table 7. Prescriptions for Context-Specific Theorizing (Davison/Martinsons 2016)

Part B1:
Published Articles

4 Design and Governance of Platform Ecosystems – Key Concepts and Issues for Future Research (P1)[10]

Title	Design and Governance of Platform Ecosystems – Key Concepts and Issues for Future Research
Authors	Schreieck, Maximilian* (maximilian.schreieck@in.tum.de) Wiesche, Manuel* (wiesche@in.tum.de) Krcmar, Helmut* (krcmar@in.tum.de) * Technische Universität München, Chair for Information Systems, Boltzmannstraße 3, 85748 Garching, Germany
Publication	European Conference on Information Systems (ECIS), 2016
Status	Published
Contribution of first author	Problem definition, research design, literature search and analysis, interpretation, reporting

Table 8. Fact Sheet Publication P1

Abstract

The purpose of this paper is to give an overview of current research in IS on the design and governance of platform ecosystems. To this end, we conduct a literature review of relevant journals and conferences. We show that platform ecosystems have been analysed from two different perspectives: technology- and market-oriented. Thereby, most studies take on the viewpoint of the platform owner. Furthermore, we summarize key concepts on the design and governance of platform ecosystems that have been discussed in literature. As most relevant concepts we identify the definition of roles, pricing, boundary resources and openness. Based on this analysis, we derive issues for future research: the integration of market- and technology-oriented perspectives, an individual level of analysis to include complementors and end-users and the role of data as boundary resource in platform ecosystems. This paper contributes to the understanding of platform ecosystems in IS literature by structuring existing research with regard to different perspectives and concepts and by providing starting points for future work. In addition, it lays out which concepts practitioners need to consider when designing and governing platform ecosystems.

Keywords: Platform ecosystem, platform governance, boundary resource, literature review.

[10] The article is also provided in the Appendix in its original format.

4.1 Introduction

"Proliferating digital platforms will be at the heart of tomorrow's economy, and even government", *The Economist* stated last year, referring to the dominance of platform ecosystems in today's economy (The Economist 2014). In a broad sense, platforms can be defined as "foundational products, services, or technologies upon which additional complementary products, services or technologies can be developed" (Gawer 2009b). The term platform ecosystem refers to the platform and all stakeholders interacting on the platform (Gawer/Cusumano 2014). The dominance of platform ecosystems can be underlined by two numbers: six out of ten of the most valuable brands in the Interbrand index have platform-based business models (Interbrand 2014) including Apple and Google with their platform ecosystems dominating the market of smartphones. At the same time, all ten start-ups included in the list of the most trending start-ups in 2015 are, to a certain extent, based on platforms (Staykova/Damsgaard 2015). The list includes for example Uber, Airbnb and Spotify as platforms connecting providers and consumers of services, and cloudera, a technological platform for processing big data.

Platform ecosystems need to attract and coordinate two or more different target groups also referred to as sides (Gawer 2009b) – in most cases complementors and customers (Tiwana 2014) – for example drivers and passengers in the case of Uber or developers and end-users in the case of an app store. The right design and a suitable governance concept are therefore key to orchestrating a successful platform ecosystem with all stakeholders (Smedlund/Faghankhani 2015). As described by Tiwana et al. (2013) in a special issue of the Journal of Management Information Systems on IT governance, new organizational forms enabled by IT such as platform ecosystems raise the questions "Who is governed?", "What is governed?" and "How is it governed?". Answering these questions in the right way is crucial for platform owners – especially in view of the fierce competition between ecosystems (Mantena/Saha 2012). The owners of platform ecosystems constantly compete with others to gain market share both in the group of end-users and complementors. For example, Amazon is trying to gain ground in the market for mobile device applications which is dominated by Google and Apple. Amazon has just launched the program "underground" as an attempt to undermine the Google Play Store on Android as marketplace for mobile applications (Dillet 2015).

Since the late 1990s, motivated by Microsoft's unpreceded success with its operating system platform Windows, IS research tries to understand how successful platform ecosystems in the IT industry need to be designed and governed (Selander et al. 2010; Messerschmitt/Szyperski 2003; Bakos 1998). Researchers analysed the technical requirements of software platforms (Baldwin/Woodard 2009), characteristics of successful platforms (Tan et al. 2015), optimal pricing for platform-based businesses (Lin et al. 2011) and control mechanisms applied on platforms (Goldbach/Kemper 2014). These aspects all relate to how platform ecosystems are designed and governed (Tiwana et al. 2010; Hein et al. 2016). However, the growing base of literature builds on different understandings of the term platform and different perspectives on platform ecosystems. While some researchers view platforms as an IT artefact (Baldwin/Woodard 2009), others define it as an abstract construct that brings together different parties (Bakos/Katsamakas 2008). As a result, findings on the design and governance of platform ecosystems lack conceptual consensus.

Several authors have already contributed to structuring the research field of platforms. Thomas et al. (2014) provide a comprehensive review from a management research point of view that not only includes platform ecosystems but also organizational platforms, product family platforms and market intermediaries. This analysis needs to be concretized for the IS field. Existing literature reviews on platform ecosystems in IS provide a focus on specific concepts related to platform ecosystems and do not provide an overview of concepts (Porch et al. 2015; Smedlund/Faghankhani 2015). In order to understand the role of design and governance in platform ecosystems, it is necessary to structure existing contributions based on their perspectives on platform ecosystems and the various concepts of design and governance they focus on. We thereby build on the framework developed by Tiwana et al. (2010) which is the first to integrate concepts of design and governance of platform ecosystems.

Towards this end, we conducted a literature review, condensing different perspectives on platform ecosystems in the first step. We determine that platform ecosystems have been analysed from two different perspectives: technology- and market-oriented. Thereby, most studies take on the viewpoint of the platform owner. In the second step, we present key concepts of the design and governance of platform ecosystems identified in literature. By discussing these concepts, our review reveals major open issues related to the design and governance of platform ecosystems: the integration of the two perspectives on platform ecosystems when discussing design and governance concepts, an individual level of analysis to consider characteristics of the actors in platform ecosystems and the role of data as boundary resource in platform ecosystems. Addressing these open issues will significantly contribute to our understanding of platform ecosystems and in particular of the key concepts of design and governance. The results will prove useful for practitioners that set up or run platform ecosystems and lack a structured overview of influencing factors on and within the platform ecosystem.

In the remainder of the paper, we first describe the process of literature search. Then, we present the results by structuring contributions according to different perspectives on platform ecosystems and by presenting the compiled concepts for the design and governance of platform ecosystems. Based on these findings, we discuss themes for future research.

4.2 Design of the Literature Review

In this review, we looked for publications that (a) focus on the platform ecosystem as unit of analysis and (b) derive explicit or implicit insights on how to design and govern platform ecosystems. Towards this end, we screened relevant outlets drawing on the guidelines by Webster/Watson (2002) and vom Brocke et al. (2009) and subsequently coded the studies with regard to their key results on platform ecosystems.

First, we conducted an all-field search (title, abstract, keywords, references) with the key word “platform” in the journals included in the Senior Scholars’ Basket of Journals of the Association for Information Systems. We screened the abstract of all 367 articles and identified 30 publications that matched both search criteria (a) and (b). If the match to our search criteria was unclear after reading the abstract, we read the full text to decide on the inclusion of the respective articles. Second, we performed a forward and backward search based on the publications gathered so far. This resulted in 40 additional articles from a variety of outlets. The sample includes books, such as the textbook "Platforms, Markets and Innovation" by Gawer (2009a), dissertations, e.g. from Qiu (2013), and articles from economic journals as long as they are related to the field of IS. Third, we extended our search to the leading IS conferences to include the most recent research topics. We focused on contributions published at the following conferences since 2013: International Conference on Information Systems (ICIS), European Conference on Information Systems (ECIS), Hawaii International Conference on System Sciences (HICSS), Americas' Conference on Information Systems (AMCIS) and Wirtschaftsinformatik (WI). We restricted the search to title, abstract and keywords and excluded research-in-progress papers. Compared to the search in journals, we used the more specific search term "platform AND (ecosystem OR architecture OR governance OR control)" in order to end up with a manageable amount of hits. Again, the articles that resulted from the search were screened and selected according to the criteria defined above. This step yielded another 27 articles (Table 9). Finally, 6 articles were added to the sample based on suggestions by the reviewers[11], leading to a total of 103 articles (see Appendix C for the full list of articles).

We then coded the selected articles along three main coding dimensions, using an explorative coding process which was repeated iteratively to develop conclusive coding constructs for each of the categories (Lacity et al. 2010). The first dimension represents the research method used in the articles. An overview of the predominant methods in a field of research helps to assess its maturity and to identify methods for future studies that complement existing research (Edmondson/McManus 2007). The second dimension covers the articles' perspectives on platform ecosystems. This builds on previous literature reviews that have identified different streams of literature on platforms and helps to take a holistic perspective on platform ecosystems. The perspective also includes whether the studies focus on the platform owner, the complementors or the end-users. The third dimension comprises all concepts related to the design and governance of platform ecosystems that are discussed in the respective article. In addition to the main coding dimensions, we gathered information on the cases and examples used in the studies. By summarizing the insights along the coding dimensions, we can carve out the focal points of existing research and identify issues for future research.

[11] Articles suggested by the reviewers: Wareham et al. (2015), Boudreau (2012), Tiwana (2015), Liu et al. (2014), Selander et al. (2013), Kude et al. (2012).

Outlet		Search	Hits	Selected
Top journals	MISQ	*“platform”* in all fields	52	8
	JAIS		35	1
	ISR		59	8
	JMIS		76	3
	ISJ		12	4
	JIT		60	4
	EJIS		45	0
	JSIS		28	2
Top confer-ences	ICIS	*“platform AND (ecosystem OR architecture OR governance OR control)”* in title, abstract and keywords (published since 2013, no RIPs)	99	5
	ECIS		89	8
	AMCIS		150	6
	HICSS		33	4
	WI		21	4
Other	Other journals	Forward and backward search (for articles in top journals)	-	22
	Other confer-ences		-	2
	Dissertations		-	3
	Books / book chapters		-	6
	Other		-	7
		Total	**728**	**97**

Table 9. Summary of the Literature Search Process (six additional articles were added during the review process)

4.3 Research on Platform Ecosystems

In this part of the literature review, we summarize the insights from the selected and coded articles on platform ecosystems in IS following the three main coding dimensions: research method, perspectives on platform ecosystems, and concepts of design and governance of platform ecosystems.

4.3.1 Research Methods

Research interest in platforms in IS has constantly increased since the late 1990s (Figure 6). First platform ecosystems such as IBM’s hardware-based personal computer platform and especially Microsoft’s tremendously successful software-based Windows platform attracted the interest of IS research. We analyzed which research methods are used in the publications and found that the majority of contributions is based on qualitative research.

67 publications apply qualitative methods, whereof 36 are based on case studies. These cases mostly focus on the successful platform ecosystems of the last decades: Microsoft with its Windows ecosystem (Eurich et al. 2011) as well as Google and Apple with their app store ecosystems (Manner et al. 2013b). Another 25 studies apply various qualitative approaches such as theory building based on qualitative insights (Grover/Kohli 2012) or expert interviews (Bergvall-Kåreborn/Howcroft 2014). Quantitative insights are presented in 28 studies. Researchers apply data analysis (Basole/Karla 2011), experiments (Goldbach/Benlian 2014), surveys (Goldbach/Benlian 2015a), simulations (Butler et al. 2014) as well as mathematical models to understand the formation of prices (Bakos/Katsamakas 2008) or to understand processes and relationships in platform ecosystems.

Plotting the data over time reveals that the share of quantitative research has increased over the last decade (see Figure 6). According to Edmondson/McManus (2007) who evaluate the maturity of research fields, this increase in the share of quantitative studies shows that the topic "platform" in IS is currently evolving from a nascent to an intermediate field of research.

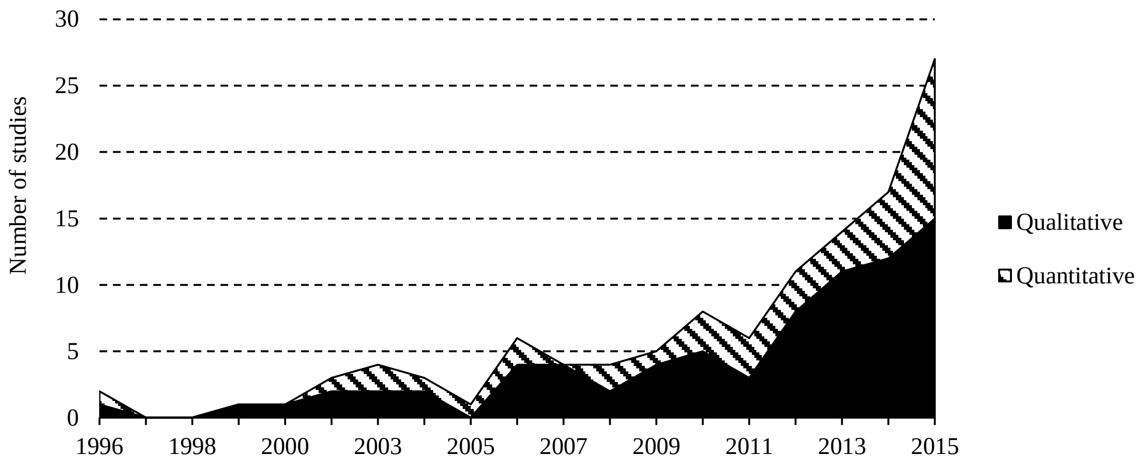

Figure 6. Number of Quantitative and Qualitative Studies on Platforms in IS Over Time (results from conference proceedings excluded, as the search was restricted to 2013-2015)

4.3.2 Perspectives on Platform Ecosystems

Our iterative coding process revealed two important dimensions along which studies take on different perspectives on platform ecosystems. First, studies have a different understanding of the platform ecosystem as unit of analysis. We therefore identify different perspectives on platform ecosystems by bringing together definitions and viewpoints from various studies. Second, studies focus on different stakeholders of the platform ecosystem, the platform owner, the complementors or the end-users. Both dimensions are discussed below. Regarding the understanding of the platform ecosystem, we identified more than 20 different definitions of the term "platform" referring to the core of the platform ecosystem. Based on these definitions and on existing attempts to cluster them, we derived two characteristics that can be used to differentiate platforms: technology- vs. market-oriented (Gawer 2014; Dibia/Wagner 2015; Thomas et al. 2014) and internal vs. external (Gawer 2014; Porch et al. 2015). As we focus our literature review on platform ecosystems, we can assume that the underlying platforms are external, i.e. they bring together different actors to enable interactions that would not be possible without the platform (Ghazawneh/Henfridsson 2011). We therefore focus on the characteristic technology- vs. market-oriented (see Table 10). The analysis suggests that the characteristic technology- vs. market-oriented is not mutually exclusive. An app store, for example, is a marketplace for apps, enabled by the underlying technology, i.e. the mobile device's operating system and its application programming interfaces (APIs). We therefore see technology- and market-oriented as two perspectives on platform ecosystems. To a certain extent, all platform ecosystems need underlying technology and will exhibit characteristics of a market.

According to the technology-oriented perspective, a platform is defined as "a set of stable components that supports variety and evolvability in a system by constraining the linkages among the other components" (Baldwin/Woodard 2009). This definition comprises software platforms such as operating systems (e.g. Apple's iOS) and hardware platforms such as IT infrastructure or computing hardware (e.g. wireless networks) (Fichman 2004). The purpose of technological platforms is to enable co-creation of value in the platform ecosystem by complementors, for example the creation of applications for an operating system platform. Accordingly, studies taking on a technology-perspective, focus on study variables that influence the intensity of the co-creation of value such as openness (Benlian et al. 2015) or the provision of boundary resources (Bianco et al. 2014).

Following the market-oriented perspective, platform ecosystems can be seen as "markets, where users' interactions with each other are subject to network effects and are facilitated by a common platform provided by one or more intermediaries" (Eisenmann et al. 2011). This definition comprises e-commerce marketplaces where goods and services are exchanged (e.g. Ebay) as well as communities where information is exchanged (e.g. Facebook). Intermediaries bring together different parties to enable a transaction between these parties (Thomas et al. 2014). While Ebay connects buyers and sellers, Facebook connects providers and consumers of information. The market perspective on platform ecosystems is rooted in economics, where characteristics of multi-sided markets have been an ongoing research topic (Weyl 2010). The purpose of market platforms is to match supply and demand on a digital marketplace. Therefore, studies taking on the market-oriented perspective focus on study variables such as the number of market sides (Economides/Tåg 2012) or the competitive strategy (Armstrong 2006) to understand price formation and the success of intermediaries.

	Technology-oriented perspective	**Market-oriented perspective**
Definition	"A set of stable components that supports variety and evolvability in a system by constraining the linkages among the other components" (Baldwin/Woodard 2009)	"Markets, where users' interactions with each other are subject to network effects and are facilitated by a common platform provided by one or more intermediaries" (Eisenmann et al. 2011)
Sub-categories	Software platform, hardware platform	Marketplace, community
Examples	Google Play, Apple App Store, SAP HANA Cloud Platform, IBM Watson	Airbnb, Uber, Spotify, Facebook
Purpose	Co-creation of value, innovation	Matching of supply and demand, exchange of information
Selected independent variables	Perceived openness Boundary resources Availability of complementary products Control mode	Number of market sides Network effects Centrality Competitive strategy
Selected dependent variables	Number of third-party applications Rate of innovation Platform adoption Platform stickiness	Welfare Equilibrium price Platform adoption

Table 10. Summary of the Technology- and Market-Oriented Perspective on Platform Ecosystems

The contributions considered in this literature review by the majority focus on one of the perspectives (Table 11). Over all outlets, only 10 studies explicitly cover both perspectives.

Article	**Perspective (Platform Ecosystem)**				**Perspective (Stakeholder)**		
	Technology		Market		Owner	Comple-mentor	End-user
	Soft-ware	Hard-ware	Market-place	Commu-nity			
Top journals							
Anderson et al. (2014)	X		X		X		
Avgerou/Li (2013)			X	X		X	
Bakos/Katsamakas (2008)			X		X		
Benlian et al. (2015)	X					X	
Bergvall-Kåreborn/Howcroft (2014)	X					X	
Bock et al. (2015)				X	X		X
Butler et al. (2014)				X	X	X	
Ceccagnoli et al. (2012)	X					X	
Claussen et al. (2013)	X		X		X	X	
Eaton et al. (2015)	X				X	X	
Fichman (2004)	X				X		
Ghazawneh/Henfridsson (2013)	X				X		
Gnyawali et al. (2010)	X			X	X		
Grover/Kohli (2012)	X				X		
Hackney et al. (2004)			X		X		
Koch/Schultze (2011)			X		X		
Koh/Fichman (2012)			X				X
Kuk/Janssen (2013)	X	X			X		
Lin et al. (2011)			X		X	X	
Lindgren et al. (2015)	X					X	
Liu et al. (2014)	X		X			X	
Lusch/Nambisan (2015)	X				X	X	
Mantena/Saha (2012)			X		X		
Markus/Loebbecke (2013)				X	X		
Ondrus et al. (2015)	X	X			X		
Rai/Tang (2014)	X				X		
Sambamurthy/Zmud (2000)	X				X		
Selander et al. (2013)	X					X	
Shaw/Holland (2010)			X		X		
Spagnoletti et al. (2015)	X			X	X	X	
Tiwana (2015)	X				X	X	
Tiwana et al. (2010)	X				X		
Yaraghi et al. (2015)			X	X	X		X
Top conferences and others							
70 articles	40	3	22	2	60	17	7
Total	**61**	**5**	**34**	**9**	**85**	**31**	**10**

Table 11. Perspectives on Platforms in IS Research

In addition to the different perspectives on platform ecosystems, we coded which stakeholder the studies in our review focus on – the platform owner, the complementor or the end-user (Table 11). The platform owner runs the platform and orchestrates the involved parties and processes on the platform. In most cases, the platform owner initiated the opening of the platform to enable the co-creation of value from third-parties (Ceccagnoli et al. 2012) or to establish an exchange platform he can benefit from. In the example of the Apple App Store, Apple itself is the platform owner, running the App Store as integrated part of the operating system iOS. The complementor is an external party not directly related to the platform owner that contributes to the platform ecosystem (Eisenmann et al. 2009). App developers who publish apps on the Apple App Store can therefore be referred to as complementors. The end-user or customer accesses the platform to consume a service available on the platform (Tiwana et al. 2010). The user of an Apple device is likely to visit the Apple App Store to download and install applications.

Of those articles, that exhibit a clear focus, 85 take the platform owner's perspective while only 31 consider the complementor, as for example Goldbach/Benlian (2015a), and only 10 consider the end-user as for example Koh/Fichman (2012) (Table 3). This observation needs to be taken into account for the discussion of concepts for the design and governance of platform ecosystems as well as for the deduction of open issues for future research.

4.3.3 Design and Governance of Platform Ecosystems

Our results show that researchers' main interest has been to understand why and how platform ecosystems in the IT industry arise and become successful in order to identify the underlying mechanisms of successful platforms. Ultimately, guidelines how practitioners can design and govern successful platform ecosystems are derived (Ondrus et al. 2015; Benlian et al. 2015; Yaraghi et al. 2015; Spagnoletti et al. 2015). The success of platforms is usually measured by its size, e.g. number of users, complementors or complementary products or services (Ghazawneh/Henfridsson 2013). For commercial platforms, size alone is not sufficient but has to be complemented by a profitable business model. While for example the success of the non-profit knowledge platform Wikipedia is measured by the number of articles, the success of an e-commerce platform such as Ebay also includes the revenue and profit Ebay generates as platform owner.

To contribute to our understanding of platform ecosystems, we aggregate insights on the design and governance of platform ecosystems across all studies identified as relevant in our literature search. Following Tiwana (2014), we differentiate insights on architecture and governance of platform ecosystems. However, we replace the term architecture by design, broadening the rather technical definition by Tiwana. He defines the architecture of a platform ecosystem as "a conceptual blueprint that describes how the ecosystem is partitioned into a relatively stable platform and a complementary set of apps that are encouraged to vary, and the design rules binding on both", whereas our understanding of the design of a platform ecosystem refers to a conceptual blueprint of the whole ecosystem, including the partners and processes interacting on the platform and that includes both the technology- and market-oriented perspective. Governance, the "partitioning of decision-making authority between platform owners and app developers, control mechanisms, and pricing and pie-sharing structures" (Tiwana 2014), covers tactical decisions that impact the processes within the platform ecosystem. Governance is related to both the technology- and market-oriented perspective as it covers technological aspects such as providing APIs and market-related aspects such as setting prices.

We identified eight key concepts focusing on the design and governance of platform ecosystems (Table 12). Some concepts are relevant for both design and governance of platform ecosystems; some primarily affect either design or governance. Furthermore, as depicted in the last three columns of the table, the concepts have been discussed from a technology- or market-oriented perspective, in some cases both. In the remainder of this section we will briefly present these concepts.

The definition of **roles** within a platform ecosystem is an important factor of ecosystem design and covers for example the number of sides it connects (Gnyawali et al. 2010), the ownership regimes (Bakos/Katsamakas 2008), the distribution of power which can be centralized or decentralized and the relationship to stakeholders of the platform ecosystem (Bullinger et al. 2012). For example, a platform ecosystem for mobile payment must balance ownership and power of three sides in the ecosystem (banks, dealers and customers) and establish relationships to partner companies that can increase its popularity (as airlines and hotels do for credit cards). Roles in platform ecosystems are discussed from both a technology- and market-oriented perspective, but few studies have integrated the perspectives.

Pricing and revenue sharing has been studied as a governance mechanism in platform ecosystems. Pricing and revenue sharing refers to payment flows within the platform ecosystem and how they are distributed between the different stakeholders. These concepts can be used to support network effects and to overcome the chicken-and-egg problem in the initial phase of a platform ecosystem (Suarez/Cusumano 2009). For example, Microsoft paid software developers to create first apps on the Windows phone platform in order to attract more users. Later on, the developers had to generate revenues by selling their apps to the end-users or displaying advertisements. Pricing and revenue sharing is mostly discussed from a market-oriented perspective. However, some studies take the technology-oriented perspective, for example when pricing for hardware components is analyzed (Bresnahan/Greenstein 1999).

Boundary resources are tools, regulations or other resources that are used to govern co-creation of value in platform ecosystems (Eaton et al. 2015). Most of the publications that cover boundary resources focus on APIs or software development kits (SDKs) that are used to facilitate co-creation of value. However, boundary resources can also stunt co-creation of value. For example, rigid regulations for the approval of complementary products or services on a platform may decrease the complementor’s motivation (Eaton et al. 2015). A boundary resource that is gaining importance in practice is data which is provided by the users of a platform and can be made accessible for the complementors (Gawer 2014). While data is mentioned as boundary resource in literature, its role is not yet analyzed in detail. Boundary resources are analyzed from a technology-oriented perspective as they impact the technical details of contributing to a platform but also complementors’ motivation. Again, only few studies integrate a technology- and market-oriented view.

Openness refers to “to the easing of restrictions on the use, development and commercialization of a technology” (Boudreau 2010). Following Boudreau (2010), a platform ecosystem can be opened by granting access to the platform or by partially giving up control over the platform. For example, Microsoft grants access to the Windows platform for application developers but stays in control, whereas in the Linux platform, the underlying technology has been made completely available to stakeholders (Ondrus et al. 2015). While choosing the right degree of openness is part of the design of a platform ecosystem, it can also be adjusted dynamically to govern the ecosystem as shown in case studies on Android and iOS (Homscheid et al. 2015). So far, openness is mostly discussed from a technology-oriented perspective as it is closely related to how access is granted to technology. Few studies also consider the market-oriented perspective or both perspectives.

In addition to these concepts, we identified control, technical design, competitive strategy and trust as relevant concepts discussed by several authors. **Control**, in general, is used to "direct attention, motivate, and encourage organizational members to act according to organizational goals and objectives" (Wiesche et al. 2011b) and IS play a key role to implement control mechanisms (Schermann et al. 2012; Wiesche et al. 2011a). In platform ecosystems, control refers to how the platform owner governs the processes within his platform ecosystem and can be divided into formal control mechanisms (e.g. output control) and informal control mechanisms (e.g. clan control) (Tiwana 2014). **Technical design** comprises the modular architecture of the platform (Tiwana et al., 2010), the definition of its interfaces and the compatibility to relevant systems. **Competitive strategy** describes whether competition, collaboration, or the mélange of both, co-opetition, is the most suitable strategy to establish a platform ecosystem among competing ones (Mantena/Saha 2012). **Trust** as counterpart of power is a basic prerequisite for a platform ecosystem to succeed (Hurni/Huber 2014). It is relevant for the relationship between platform owner and complementors as well as for the relationship between customers and the platform ecosystem as a whole. Similar to the concepts described above, only few studies integrate the technology- and market-oriented perspective when discussing control, technical design, competitive strategy and trust.

Concept	Aspects	No. of studies		
		technology-oriented	market-oriented	both
Roles	▪ Number of sides ▪ Ownership ▪ Distribution of power ▪ Relationship to stakeholders	15	14	2
Pricing and revenue sharing	▪ Achieving network effects ▪ Barriers to market entry ▪ Subsidizing of one or more sides	8	16	3
Boundary resources	▪ Software tools (API, SDK) ▪ Documentation ▪ Data	14	7	2
Openness	▪ Granting access to technology ▪ Giving up control over technology	13	3	2
Control	▪ Informal control mechanisms ▪ Formal control mechanisms	12	1	2
Technical design	▪ Modularity ▪ Interfaces ▪ Compatibility	10	4	1
Competitive strategy	▪ Competition ▪ Co-opetition, collaboration ▪ Single vs. multihoming	1	5	1
Trust	▪ Relationship complementor – platform owner ▪ Relationship end-user – platform	1	1	1

Table 12. Concepts of Design and Governance of Platform Ecosystems

4.4 Central Issues for Future Research on Platform Ecosystems in IS

In this section, we discuss central issues for future research on the design and governance of platform ecosystems in IS based on the insights gained in the analysis of existing literature. We discuss three major issues: the integration of the different perspectives on platform ecosystems when analyzing design and governance concepts, an individual level of analysis in platform ecosystems and the role of data as boundary resource in platform ecosystems. We suggest that future research on these issues will deepen our understanding of platform ecosystems and allow to derive recommendations for their implementation and management in practice.

4.4.1 Integrating Different Perspectives on Platform Ecosystems with Design and Governance Concepts

Future research can gain additional insights on how to design and govern ecosystems by integrating the technology- and market-oriented perspective on platform ecosystems. None of the platform-based businesses can be described with only one of the perspectives (Basole 2009). An app store, for example, is a marketplace that matches demand for and supply of applications on mobile devices. At the same time, the app store is the platform owner's vehicle to co-create value on his technological platform, i.e. the operating system of the mobile devices. To understand such platform ecosystems that can be interpreted as two interlaced platforms – a technology and a market platform – the technology- and market-oriented perspectives have to be integrated. Existing literature rarely adapts an integrated view, as shown in our review.

All of the constructs related to the design and governance of platform ecosystems that we have identified in our literature review, can be viewed from a technology- and a market-oriented perspective. For example, providing boundary resources such as APIs or development tools is, on the one hand, a technological aspect of governance used to incentivize developers to contribute to a platform ecosystem. On the other hand, providing boundary resources will also impact the platform ecosystem as a marketplace by increasing the competition between developers. Similarly, the agreement on decision rights for the different stakeholders within the platform ecosystem is influenced by technology- and market-oriented considerations: decision rights for developers on a platform may include the tools and frameworks used but also the prices that can be set in the market.

First contributions integrate the different perspectives with regard to specific phenomena. For example, Claussen et al. (2013) discuss incentives for developers of Facebook apps while interpreting the Facebook app store as market and technological platform. Yet, many concepts related to the design and governance of platform ecosystems still need to be evaluated against the integrated view. Cusumano (2010b) stated that "[w]ho wins and who loses these competitions is not simply a matter of who has the best technology or the first product. It is often who has the best platform strategy and the best ecosystem […]." In order to come up with the best strategy for a platform ecosystem, research and practitioners need to consider both the technology- and the market-oriented perspective.

In doing so, research should not only focus on case studies of successful platform ecosystems, as "successful […] platforms are the exception" (Hagiu 2014). Insights from failed platform ecosystems can enhance the field and provide additional insights. Within multiple-case studies of successful and non-successful platform ecosystems, patterns for successful design and governance strategies could emerge. As a starting point, a case survey of existing case studies as described by Jurisch et al. (2013) could provide valuable insights.

4.4.2 An Individual Level of Analysis for End-users and Complementors

Our review revealed that most studies focus on the platform owner, neglecting the perspective of the end-user or complementor. For example, Table 3 shows that no study with a technology-oriented perspective takes on the end-user perspective although the end-user is also affected by technological decisions of the platform owner. The complementor's perspective, even though adapted by several more recent publications (Goldbach/Benlian 2015a; Bergvall-Kåreborn/Howcroft 2014; Hurni/Huber 2014), is based on an abstract representation of the complementor, its characteristics are not considered on an individual level of analysis. Bergvall-Kåreborn/Howcroft (2014) argue that complementors and end-users need to be seen as individuals because their different characteristics can impact the relationship they establish to the platform ecosystem. Including the complementors and end-users into the analysis, will also allow to discuss a bottom-up approach in the design and governance instead of interpreting it as a top-down approach only – a gap that has recently been shown by Constantinides/Barrett (2015).

A software developer from an open source community might be incentivized by open interfaces and the freedom to decide on the tools and frameworks to use. A start up, on the other hand, might focus on reliable, documented interfaces and adequate pricing and revenue sharing. Depending on which types of complementors a platform owner wants to attract, different design and governance concepts may prove useful. To understand the role of individual complementors and end-users, future research should take on an individual level of analysis. Experiments or simulations could generate insights detached from specific cases as for example in the experiment by Goldbach/Benlian (2014) who compare different control mechanisms in platform ecosystems. Similar to Schilling et al. (2011) who evaluate the motivation of open source software developers depending on their personality, personality traits and more specific characteristics such as a complementor's self-efficacy or goal setting could be evaluated. In doing, so it could be worthwhile to not only analyse current complementors and end-users of a platform but also complementors who failed with their product and end-users who have already turned their back on the platform ecosystem.

Complementors and end-users are not necessarily individuals. Especially in the case of business-to-business platform ecosystems, complementary products are created by and sold to companies. Instead of a large crowd of developers, the platform owner has to govern a group of partner companies. Some of them might be strategic partners that enhance the platform ecosystems value for customers significantly. With regard to the customer companies, a platform needs to provide firm-specific solutions that are still based on the same technological platform, a challenge that for example all ERP system providers are facing at the moment. Based on research on interfirm networks, the role of relationships and strategic partnerships could be a worthwhile area for future research.

4.4.3 Data as Boundary Resource in Platform Ecosystems

In our analysis of existing literature, we identified the concept of boundary resources as one of the most important governance mechanisms. At the same time, Gawer (2014) depicts the importance of data as boundary resource. However, no article explicitly analyses the role of data as boundary resource in platform ecosystems. In practice, many of today's platform ecosystems are fuelled by data. For example, Google and Facebook use the aggregated user data to sell personalized advertisements, attract developers by providing selected data streams via API (Gawer 2014) and build additional services such as Google's real-time traffic information service based on movement data of Android users (Barth 2009). As data is usually provided via APIs, it is also worthwhile to analyse how these interfaces define standards for data exchange and how these standards change over time. This might affect the optimal design and governance of platform ecosystems.

Data that is aggregated in a platform ecosystem can even be a threat. Developers can use the data aggregated by their own apps to strengthen its competitive position vis-à-vis the platform owner. For example, fitbit, a seller of fitness trackers, uses the data aggregated by its iOS and Android apps to establish its own ecosystem based on wearables – perhaps one reason why Apple and Google push their own fitness and health ecosystems Apple Health and Google Fit (Pressman 2015). The way the data flow is handled in platform ecosystems is therefore an important aspect of platform governance, largely neglected in existing literature.

First publications have touched the topic of data in platform ecosystems in the context of open data (Ponte 2015), wearables (Sun et al. 2015), and inter-organizational collaborations (van den Broek/Veenstra 2015) but did not explicitly consider its role as boundary resource. A first step would be to evaluate how data is used to govern platform ecosystems in practice and to generalize the findings. This will enhance research on governance of platform ecosystems and address a topic that is highly relevant in practice.

4.5 Conclusion

In this paper, we summarized recent literature on platform ecosystems and derived open issues for further research based on the results. We analyzed the methodology applied by the studies in our review, determined different perspectives research takes on platform ecosystems and condensed the key concepts of design and governance of platform ecosystems. In doing so, we identified three major issues for further research. First, we suggest to integrate the market- and technology-oriented perspective when discussing phenomena on platform ecosystems. This is in particular relevant for design and governance concepts such as boundary resources or openness that are implemented technically but impact the market-related processes on the platform. Second, we think that future research needs to integrate complementors and end-users into the analysis in addition to the platform owner. An individual level of analysis would further contribute to our understanding as each contributor and end-user is different. Third, we recommend to study data as boundary resource in more detail. Data has been mentioned in several contributions as boundary resource fueling platform ecosystems and is highly relevant in practice.

By reviewing existing literature and deriving issues for future research, our study contributes to IS governance literature in several ways. First, we provide a holistic overview on research related to the design and governance of platform ecosystems. The overview integrates contributions that were previously not related due to a heterogeneous understanding of platforms and platform ecosystems. Thereby, we provide a unified foundation for future research on design and governance of platform ecosystems. Second, we summarize concepts related to the design and governance of platform ecosystems across all studies. In doing so, we identify the key challenges relevant for all platform ecosystems and reference the current state of research regarding these challenges. Third, we derive specific issues for future research that are rooted in existing research but show how our understanding of platform ecosystems and their governance can be enhanced. Finally, our study is relevant for practice by laying out which concepts practitioners need to consider when designing and governing a platform ecosystem. Currently, digital platforms spring up like mushrooms while others are withering and practitioners try to figure out how to bring them to success. The issues we identified will provide useful in practice and will further advance the applicability of the scientific findings on platform ecosystems.

The results of our study underlie several limitations. First, the literature search might not cover all relevant studies due to the choice of outlets and keywords. For example, alternative terms for the concept of platform ecosystems such as software ecosystem, partnership network, etc. might yield additional relevant articles. Second, the coding process we conducted simplifies the results of the studies to make them comparable. Similar concepts were merged to superordinate concepts, as summarized in Table 58 in Appendix C. In the course of this process, some insights might have been lost and are not represented in our results. A greater level of detail within studies that focus on specific concepts might generate additional insights. Third, our twofold perspective on platforms in IS, market- and technology-oriented needs to be concretized with further cases from practice. While the perspectives are based on existing literature on platforms, we could not clarify all communalities and differences between the perspectives within the scope of this review. Fourth, the issues for future research that we derived from our results may be influenced by the authors perspective and the topic. Further open issues might therefore exist and can be discovered by future work.

4.6 Acknowledgements

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5 Co-Creating Value Through Openness and Collaboration – An IT Platform for Open Banking (P2)[12]

Title	Co-Creating Value Through Openness and Collaboration – An IT Platform for Open Banking
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Publication	European Conference on Information Systems (ECIS), 2017
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Contribution of first author	Problem definition, research design, data collection and analysis, interpretation, reporting

Table 13. Fact Sheet Publication P2

Abstract

Inspired by the success of digital-native companies such as Google or Salesforce, established companies such as car manufacturers, equipment manufacturers, or banks strive for value co-creation via open IT platforms. However, literature on value co-creation does not cater to the specific situation of established companies. Addressing this gap, we seek to improve our understanding of how established companies can co-create value through openness and collaboration with IT platforms. Based on an exploratory field study of a European bank that is introducing an IT platform, we show that openness and collaboration enable value co-creation while creating areas of conflict and potential benefit. For example, openness creates internal resistance and exposes technology while facilitating internal transparency and standardization. Collaboration entails conflicts with existing partners that are affected by the value co-creation strategy, but existing partners are also assets in incentivizing collaboration with third-party developers. Contributing to literature on value co-creation and openness of IT, we confirm that established companies can benefit from IT platforms but need to address specific areas of conflict and potential benefits related to balancing openness and control and governing collaboration. Our discussion provides first insights for established companies that consider implementing an IT platform strategy.

Keywords: IT platform, Multi-sided platform, Value co-creation, Established companies, Openness, Collaboration, Governance, Third-party developer, Digital business strategy, Exploratory case study.

[12] The article is also provided in the Appendix in its original format.

5.1 Introduction

Information technology (IT) has enabled companies to create value in a purely virtual environment (Rai/Tang 2014). Through these technologies, "digital-native" companies such as Google, Facebook or Salesforce offer digital services like mobile apps, communication and games or customer relationship management (CRM) to their customers. Those services are predominantly provided by third-party developers, i.e. actors that independently develop applications that are complementary extensions to the digital-native companies' key offerings (Ceccagnoli et al. 2014; Huntgeburth et al. 2015). The collaboration between the digital-native companies and the third-party developers enables co-creation of the digital services offered for customers. As value co-creation is enabled through the collaboration among different actors, it is only possible if access to company resources is given to the third-party developers (Tiwana et al. 2010). Digital-native companies provide this access though openness of their IT systems, usually by designing IT platforms with open interfaces. Value co-creation through openness and collaboration has proven to be a promising path to success for many digital-native companies (see examples provided by Rai/Tang 2014).

Triggered by the success of the digital-native companies, established companies in turn, strive for value co-creation through openness and collaboration. With the term "established", we refer to companies whose key offering dates back to before the dotcom bubble (e.g., cars, TVs, washing machines) who are still active in this market. The goal of these companies is to enable open innovation through collaboration with third parties (Huff et al. 2013; Reichwald/Piller 2006). For example, the car manufacturer BMW operates an IT platform "BMW Connected" that offers various digital in-car services. These services have been created in collaboration with numerous third-party developers who have been given access to the platform.

Established companies face particular challenges when they want to move the co-creation of digital services and as such the collaboration with their third-party developers on designated IT platforms because these companies already have an established IT landscape that has been utilized for value creation. IS researchers have studied how IT-enabled openness triggers collaboration and, ultimately, can lead to value co-creation (Schlagwein et al. 2010). For example, the optimal degree of openness (Ondrus et al. 2015; Boudreau 2010), or suitable governance mechanisms to manage collaboration with third-parties on platforms (Tiwana 2014; Tiwana et al. 2010) have been discussed. However, these results are, by vast majority, deducted from analyses of digital-native companies such as Google, Facebook or Salesforce. Consequently, it is unclear to what extent these findings are applicable to established companies and how the specific challenges of established companies are addressed by our existing understanding of value co-creation through openness and collaboration.

For example, established companies draw on their legacy systems when designing and implementing the IT platforms to be accessed by third parties (Lyytinen/Rose 2003). However, the legacy systems are connected with other IT systems within the company and by opening them to external parties, the company risks to expose critical information and knowhow. Furthermore, openness of the IT platform may have a detrimental impact on employee's motivation. Research on the *not-invented-here* and *not-shared-here* phenomena shows that openness can lead to internal resistance to collaboration with external parties (Burcharth et al. 2014). Consequently, it is unclear to what extent existing findings on value co-creation are applicable to established companies and how the specific challenges of established companies can be addressed by our existing understanding of value co-creation through openness and collaboration. Therefore, we strive to answer the following research question: *How can established companies successfully co-create value through IT platforms that utilize the concepts of openness and collaboration?*

To answer this question, we engage in an exploratory field study with a large European banking company that is introducing an open IT platform to spark value co-creation. The banking context is particularly interesting when analyzing the transition towards a value co-creation strategy: First, digitization creates pressure on established banks to offer innovative digital services to their customers (Mention et al. 2014). Start-ups from the IT domain referred to as "fintechs" have come up with innovative solutions that target the core of the banking business, putting pressure on established banks to find appropriate responses. Second, due to the criticality of the data in banking and the need for security, banking companies have traditionally built up closed IT systems and have only collaborated in close strategic partnerships. Over the years, these IT systems have become highly complex and every structural change represents a huge challenge to the banking companies. Third, the European banking sector is affected by changes in regulation as for example triggered by the financial crisis in 2008. These changes need to be accommodated by the IT systems, which consumes valuable resources no longer available for innovative projects (Mention et al. 2014).

With this exploratory field study, our goal is not only to sketch the situation of that specific banking company striving for value co-creation but also to contribute to our theoretical understanding of value co-creation through openness and collaboration for established companies. To do so, we establish a theoretical pre-understanding of how openness leads to value creation through collaboration on IT platforms and embark on an exploratory field study. We derive areas of conflict and potential benefits that established companies face when shifting to a value co-creation strategy.

5.2 Theoretical Background

As recommended for exploratory field studies (Walsham 1995), we develop a theoretical pre-understanding of value co-creation, with openness and collaboration as main constructs that facilitate value co-creation (Figure 7). We present our theoretical pre-understanding along the three elements (1) value co-creation, (2) openness and (3) collaboration.

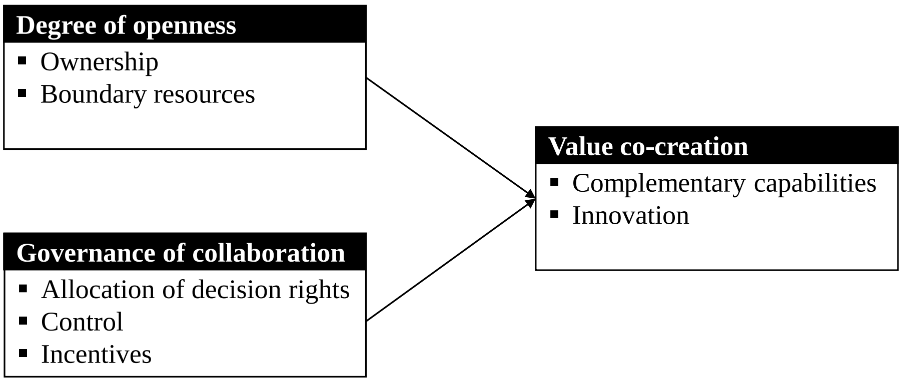

Figure 7. Theoretical Pre-Understanding of Value Co-Creation through Openness and Collaboration

The focus of value creation shifts from linear value creation in supply chains to **(1) value co-creation** within networks of companies, often facilitated by IT platforms (Fuentelsaz et al. 2015b; Sarker et al. 2012; Huntgeburth et al. 2015). We define IT platforms as "[…] the extensible codebase of a software-based system that provides core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate" (Baldwin/Woodard 2009; Boudreau 2007), allowing companies to collaborate with third-party developers in order to co-create value. Following a resource-based view, value co-creation is a result of combining complementary resources and capabilities in a process of collaboration (Lavie 2006b). Besides sharing knowledge and assets, governance structure that frames collaboration is prerequisite for value co-creation (Grover/Kohli 2012). For many companies, a key goal of value co-creation is innovation, as they lack innovative capabilities and want to benefit from the creativity and impartiality of externals (Yoo et al. 2012; Yoo et al. 2010; Boudreau 2010). To combine complementary capabilities and to realize joint innovation, openness on the technology level is required (Ceccagnoli et al. 2012; Huff et al. 2013; Reichwald/Piller 2006).

Through **(2) openness,** the focal firm grants third-party developers access to its IT. These third-party developers can then build complementary applications, which are consumed by the end-users (Benlian et al. 2015). Usually, this process is mediated by an IT platform. Openness, in its most extreme form, can mean to give up ownership of the technology and make it accessible as a whole to everyone. Open source platforms such as Linux show that such a high degree of openness can lead to flourishing platform ecosystems (Economides/Tåg 2012; Eisenmann et al. 2009). However, in commercial platforms, the ownership of the technology in most cases lies with the focal firm, which acts as platform owner. Through boundary resources such as application programming interfaces (API) and associated tools and documentation, third-party developers are granted access to the technology (Eaton et al. 2015; Ghazawneh/Henfridsson 2013). Depending on the characteristics of this access, different degrees of openness can be realized. Finding the right degree of openness is an important challenge (Schlagwein et al. 2010). A high degree of openness stimulates activity on the platform and, through positive network effects, can lead to a flourishing platform ecosystem (Parker/Van Alstyne 2005). At the same time, with a high degree of openness, the focal firm gives up its control of the relationship with the customers. Third parties intervene with potentially innovative solutions for the end-users while the focal firm is at risk to be reduced to a pure technology provider. IS literature has shown that openness on the technology level contributes to a platform's market potential while openness on the provider level can have a negative impact on the market potential (Ondrus et al. 2015).

While openness is prerequisite for enabling value co-creation via an IT platform, the focal firm will only be able to create value from the platform if it can successfully realize **(3) collaboration** with third-party developers. Governing collaboration on a platform is a challenging endeavor that has been discussed extensively in IS literature. Collaboration ca be governed through the three mechanisms *allocation of decision rights*, *control*, and *incentives*, which are also referred to as governance mechanisms (Tiwana et al. 2010; Manner et al. 2013b). By allocating decision rights to third-party developers, a decentralized governance structure is established that grants greater independence to third-party developers as compared to suppliers in a supply chain (Hein et al. 2016; Schreieck et al. 2016b). For example, the third-party developer is free to come up with the specification of his complementary product, whereas a supplier has to fulfil the focal firm's specification. This autonomy creates space for innovation (Shi et al. 2016; Yoo et al. 2012). At the same time, the platform owner needs to apply control mechanisms in order to ensure the integration and quality of complementary products. Both formal control mechanisms such as quality checks and informal control mechanisms such as clan control through a community of third-party developers have been shown to be effective (Boudreau 2010; Goldbach/Benlian 2014, 2015a; Goldbach/Kemper 2014). Furthermore, third-party developers need to be incentivized to collaborate on the platform, which is mainly done via revenue sharing. The optimal revenue sharing depends on many factors such as the end-users willingness to pay for quality (Lin et al. 2011) or the position of the focal firm relative to competitors (Hagiu 2006).

In sum, the theoretical pre-understanding shows that the current state of IS research can be condensed to a model explaining value co-creation through openness and collaboration. However, the current understanding is not sufficient to cater to the specific challenges of established companies that shift towards a value co-creation strategy. For example, the impact of legacy systems or the company's culture on openness, the influence of existing partners and customers on collaboration or the interplay of existing mechanisms of value creation and the to-be established mechanisms of value co-creation are not covered. This is illustrated by the fact that almost all case studies in the context of value co-creation focus on digital-native companies and start-ups such as Google, Facebook or Salesforce (e.g. Claussen et al. 2013) or other companies active in mobile payment (e.g. Gannamaneni et al. 2015; Ondrus et al. 2015), e-commerce (e.g. Avgerou/Li 2013), and cloud computing (e.g. Huntgeburth et al. 2015).

5.3 Research Design

Based on the theoretical pre-understanding, we selected *APIbank* (anonymized) as a suitable case to improve our understanding of value co-creation for established companies. In this section, we describe the case and our methodological approach.

5.3.1 Case Description

APIbank is a global banking and financial services company based in Europe. It runs offices in more than 70 countries and generates the lion's share of its revenue with investment banking. The company sees itself in a process of digital transformation with the goal to offer a seamless customer experience via multiple channels for both individual and business customers. The process of digital transformation is also the company's answer to the "fintechs", tech start-ups attacking the key business of established banking companies. One example of a fintech is Lending Club, a UK-based platform for peer-to-peer money lending, excluding established banks from their core business of gathering money from customers to lend it to others. One important step in the digital transformation of *APIbank* is the creation of an open API platform. This platform makes some of the banks data and functionalities accessible to third-party developers. Via APIs, the developers can integrate data or features into their applications. For example, a third-party developer could build a tool for small companies that integrates their transactions and invoicing with their account at *APIbank.*

We selected *APIbank* as company for the case study as the banking context represents a promising area of study. Banking is an industry in which the direct contact with the end-users regardless whether they are individuals or businesses has traditionally been the basis for conducting business. The direct contact builds trust, an essential factor in customer relationships which is even more relevant in banking than in other industries. However, openness and collaboration with third parties brings additional actors in the customer relationship, creating areas of conflict as well as potential benefits for *APIbank.*

5.3.2 Exploratory Field Study

To close the theory gap of value co-creation through openness and collaboration for established companies, we take on an interpretivist stance (Conboy et al. 2012; Goldkuhl 2012) and conduct an exploratory field study with the company *APIbank* (Miles/Huberman 1994; Yin 2014; Walsham 1995). In this setting, an exploratory field study is suitable for two reasons. First, the subject of our study, established companies that adopt a value co-creation platform strategy, is complex and dynamically evolving. It is thus advisable to study this phenomenon in its context with an iterative interplay of data collection and analysis. Second, the theory gap we identified is worthwhile to be researched with an explorative, inductive approach. Due to the heterogeneous and young field of platform theories, developing a theoretical framework and formulating hypothesis upfront is hardly feasible (Urquhart et al. 2010; Creswell 2013).

Conducting the exploratory field study, we iteratively collected interview data, as interview data provides access to the participants' interpretations of the phenomenon (Walsham 1995; Miles/Huberman 1994). We conducted semi-structured interviews with employees and externals involved in the open API project in different positions following the guidelines by Gläser/Laudel (2009). To embrace depth and richness of the data, we conducted the interviews inspired by grounded theory methodology (Glaser/Strauss 1998; Urquhart 2013; Mason 2006). That is, we iteratively revised our interview guidelines based on the insights of interviews that we had already conducted. We chose subsequent interview partners based on the saturation of our constructs from the data that we had already collected. In total, 11 interviews were conducted between April and July 2016 (Table 14). Most of the interview partners have previous experience related to open innovation and value co-creation in IT. The interviews lasted 52 minutes on average. The interview questions covered the decision process that led to a co-creation strategy, the architecture of the open API, internal and external challenges as well as expectations associated with the value co-creation strategy.

ID	Role	Brief description
PM	Project manager	▪ Vice president of *APIbank* and project manager of the open API project ▪ 6 years of experience in open innovation and open API projects ▪ Participation in various workshops on open innovation in the IT context
PT_1	Project team member	▪ Architect head for digital transformation and innovation ▪ Several years of experience with projects in the context of innovation and openness of IT
PT_2	Project team member	▪ Innovation manager with experience in open innovation at different companies ▪ First employee to push the open API idea
PT_3	Project team member	▪ Product marketing and strategy ▪ Former researcher with a focus on innovation and open innovation in large companies
PT_4	Project team member	▪ Lead digital solution architect ▪ Responsible for internal adherence to API standards
PT_5	Project team member	▪ Solution architect ▪ Product owner of internal API that forms the basis of the open API
RT_1	Member of related teams	▪ Solution architect in the investment department ▪ Designing the connection of IT services in the investment department and the open API
RT_2	Member of related teams	▪ Technical specialist in the investment department ▪ Implementing the connection of IT services in the investment department and the open API
TP_1	Third-party developer	▪ Experienced third-party developer ▪ 19 years of experience in web development
TP_2	Third-party developer	▪ Junior third-party developer ▪ Some experience in Java applications
EX_1	External consultant	▪ Experienced external consultant with focus on open innovation projects ▪ Focus on operating mode for the bank with regard to the open API project

Table 14. Profiles of the Interviewees

Based on our interpretivist stance, we applied grounded theory based coding techniques following the Glaserian approach (Glaser/Strauss 1998; Urquhart 2013). We started with open coding and created more than 250 codes associated with more than 500 interview quotes. In axial coding, we identified 12 main categories of codes that included more than 40 subcategories. Subsequently, we conducted selective coding to relate the categories to our theoretical preunderstanding (Table 15). Following the principle of constant comparison (Urquhart et al. 2010), we returned to the data whenever a relationship emerged in the selective coding to verify its grounding in the data.

Interview statement and exemplary open codes (underlined)	Subcategories	Category
"We have critical mass already.[1)] […] compared to start-ups, something like the Solaris Bank who were also offering banking as a service to start-ups. But their problem is that they can only offer a backend but they cannot offer customers. On our platform, we have several million customers. The thing is that for our platform the external developers will be able to access […] all our customers.[2)]"(PM)	1) Advantage of established company 2) Incentive for developer to participate in open IT platform 2) Collaboration	Potential benefit (Collaboration → Value Co-creation)

Table 15. Illustration of the Coding Scheme

5.4 Results and Interpretation

The analysis and interpretation of our interview data helped us to, first, understand how *APIbank* applies openness and collaboration to co-create value through an IT platform and, second, which areas of conflict and potential benefits result from the new value co-creation strategy.

5.4.1 Openness

The interviews we conducted at *APIbank* shed light on why the company strives for more openness on the technology level and what consequences might come along with increasing openness. While the bank keeps ownership of its technology, it grants access to banking functions via APIs accompanied with additional boundary resources. In particular, a developer portal, API documentation, sample code and sample applications support third-party developers in their development process. With open APIs and the associated resources, *APIbank* aims at attracting developers that build innovative third-party applications on top of the open API platform. As the project manager summarized:

> *"Our plan is to support [the developers] in this activity by providing them with an easy to onboard and easy to use […] environment that it is really effortless to use. And a comfortable set of developer tools around this API, good documentation, good sample code, basically we are aiming for developer convenience. This is what we are going for. And this is what is going to make it attractive for people to use and if that's the case then it will spark innovation." (PM)*

Also from the third-party developers' perspective, openness provided by APIs is a suitable tool to facilitate innovation. Easy access to the API and the possibility to try out the different features of the API motivates third-party developers to produce prototypes:

> *"I think the great [thing] about APIs is that you can debug prototypes very easily faster. And that's related to innovation because I feel like there are lot of smart innovation methods to ideate things to define thinking but at the end it is to create something people can touch. And if you are able to create this fast." (TP_1)*

Area of conflict – Internal resistance. The idea of an open API platform was generated bottom up by a small group of employees that recognized the trend of fintechs targeting *APIbank's* key markets. While the project was supported by top management early on, middle management and parts of the staff were opposed to the open API project. Middle management criticized that the considerable investment in the project came along with uncertainty about the financial outcome. Compared to digital-native companies that opened their systems from the beginning, established companies need to invest in a redesign of existing IT systems to make them ready for more openness. Therefore, middle management feared the negative impact of the open API on their key performance indicators and asked the project team for business cases of the open API project:

> *"when I talk to managers on […] managing director level, and they would ask me for business cases. That puts me in the situation to explain, that open innovation approaches do not work the pipeline way, in which in-house products are designed and produced and introduced to the bankers […]. So, it is not always easy for me to supply them with business cases […]" (PT_3)*

Beside the reluctance of middle management, staff is concerned how openness affects their work and their role. Partnering with third-parties through open IT such as an IT platform requires an open mind-set and the willingness to share not only knowhow and experiences but also potential revenue with third-parties. As hypothesized by the *not-shared-here* phenomenon (Burcharth et al. 2014) personnel of *APIbank* in parts tends to be opposed to collaborate with externals.

> *"The [concern] is that the understanding of partnering and that the business can change, is also a change in the mind-set. Probably you are afraid that in a future world your role might look different. All these things. Bottom line is, […] understanding the API as well as what would it mean for the organization and the person who you are talking to." (PT_2).*

This internal resistance poses a threat to the project as the open API project team relies on the support from middle management as well as from other teams that work on the provision of banking functionality through IT systems.

Area of conflict – Criticality of technology. A further area of conflict arises from the criticality of banking functions. As a result, the decision what features and data to make accessible via the API is coordinated through a long and circuitous process that includes both business and technology functions within *APIbank*.

> *"The main thing is that before we go live with any new functionality, we have to go through legal obligations and all those business functions which verify if it's ok to go live and then still our business counterpart has to verify if this functionality or the data behind it fits into what people might do with it and therefore if it's okay for the business to provide the data to other people out there or not." (PT_4)*

In the first step, *APIbank* decided to only provide read functionality for most functions via the API. Third-party developers, however, expect access to the functions that they associate with banking, i.e. *"the online banking functionality I am used to"* as one third-party developer (TP_1) stated. This goes beyond read functionality and includes functions such as executing financial transactions. As the open API project does not fulfil that expectation yet, it remains questionable whether the degree of openness is sufficient to incentivize third-party developers to join the platform.

Potential benefit – Internal transparency and standards. Striving for openness in an established business with grown IT systems also entails potential benefits. Openness to the outside first requires transparency and standards on the inside. Existing data sets have to be reviewed, revised and structured consistently before they can be published via an API. Similarly, backend functionality has to adhere to internal standards in order to make it accessible via APIs. As the backend functionality has grown over years, *APIbank* had to reengineer parts of the backend or use an internal middle layer to standardize the functionality. In the long run, this leads to a cultural change within *APIbank*, reinforcing internal transparency and standards:

> *"We have this approach that you have to create properly one pool of data because it is really interesting for others to work with the data. We have to simplify the structure via API functions to the backend […] and then you have the organization who was used to work in silos and the you have a cultural change." (PT_2)*

The project manager is convinced that the open API project will be of formative character for internal culture and, henceforth, for the management of internal development projects.

> *"[…] internally, API will become a philosophy, so it will be clear that access through any system happens only via API." (PM)*

5.4.2 Collaboration

By establishing openness through the open API project, *APIbank* strives for collaboration with third-party developers to enable innovation. Both individual developers and other companies are encouraged to leverage the APIs for their own applications. As the third-party developers are not part of the company and often not even of the industry, they do not suffer from organizational blindness (Knudsen 2011) and therefore are more likely to create innovative ideas and applications:

> *"[…] the purpose of the banking API is to attract people, to attract businesses to use the API to enhance some offering that isn't obviously connected to banking but somehow profits from banking. So this is the objective." (PM)*

Granting access to an API alone is unlikely to spark sustainable activity of third parties on the platform. A set of mechanisms referred to as governance mechanisms needs to be implemented to establish collaboration on platforms (Tiwana 2014). By allocating decision rights among the actors on the platform, controlling the activities and products on the platform and incentivizing third parties to join the platform, a suitable governance strategy can be implemented (Tiwana 2014; Tiwana et al. 2010). Regarding the allocation of decision rights, *APIbank* keeps all strategic and implementation-related decision rights on the platform level. Strategic and implementation-related decision rights on the application level are in large parts allocated to the third-party developers. However, some boundaries are defined by *APIbank* regarding for example the quality standards of the application. These boundaries are enforced with control mechanisms such as a formal input control of application that are created on the platform:

> *"The third-party apps […] have to fulfill some standards. There will be due diligence on the apps before they are allowed to start using the […] API. So we will do a due diligence on the apps similar to what Apple does." (PM)*

APIbank strives to gather early feedback of the third-party developers on how they perceive the governance strategy and to actively include them in the improvement of the governance.

> *"[…] run a couple of hackathons and just get feedback. It is most important. […] And just don't wait for years, just get started and ask for the feedback because [the third-party developers] tell exactly what is good and not. There's lot discussion about what's the best technology, what's the standard, how to design an API, technology wise that's quite important. […] How to design a good API. But main thing is asking for feedback, the users. That's the main thing." (PT_1)*

Area of conflict – Migration of partners. As *APIbank* has a long history of partnering with selected companies, these established partners will be affected by the new value co-creation strategy**.** The mode of collaboration is changed from close partnerships to standardized relationships on the platform. Thereby, the partners give up decision rights as *APIbank* defines how collaboration is organized and no individual agreements are negotiated. This is laid out by the project manager:

> *"I think the biggest difference between partner approach and open [approach] is that in the partner approach you are entering a specific and individual business agreement with a specific partner where there is a lot more responsibility on the bank's side, which is more the classical model where you have to do vendor risk management and other things which is all very expensive and very time consuming. Whereas in the open case most of the responsibility isn't with the bank. It is a very, very clearly defined interface with generic conditions with no special terms regarding the API consumer." (PM)*

This change may lead to conflicts with the existing partners who lose the status of being one of few exclusive partners.

Area of conflict – Image of being inert. Another area of conflict results from the inflexible, slow image which is often attributed to established companies such as *APIbank*. The sheer size of many successful established companies along with the business processes that have been established over the years lead to long lead times of new projects and organizational changes (also referred to as organizational inertia, e.g. Hannan/Freeman 1984). Established companies oftentimes are not perceived as frontrunners in the area of innovative digital solutions, in particular compared to digital-native companies such as Google, Facebook, Salesforce or fintech start-ups. One member of the project team at *APIbank* acknowledges:

> *"We can't build with what we want because they are lot of other internal operational processes which don't allow going in that direction. We have limited access to some sources. Fintechs don't have all these problems. [They] just can try, they can throw it away if it doesn't work. And they are really fast. And this is the thing we have to change in our process […]. They can just start to build from scratch,*

> *and they can whatever just produce something quickly, couple of weeks sometime. They can just try it and go to the market, see if it works and that's it. […] If we start a project it will take months sometimes more than a year to go to production. This is the big advantage of fintechs." (PT_1)*

This image can be harmful to *APIbank's* open API project as the project is depending on collaboration with innovative developers.

Potential benefit – Existing partners. The existing partners of *APIbank* not only represent an area of conflict but also a potential benefit. Partners who used to work closely together with *APIbank* can promote or even sponsor the platform which helps to establish the platform on the market (Eisenmann et al. 2009). In particular, in the early phase of the platform, existing partners can test the platform, give valuable feedback and develop first applications that showcase the potential of the APIs. Therefore, *APIbank* started with selected existing and new partners in the API project before making the APIs available to everyone:

> *"For the very start we stuck with the partnering approach because this is a very early stage thing now. And we wanted simply to start with handful of selected partners, […] it's a development based planning approach." (PT_5)*

Potential benefit – Existing customers. The existing business relationships that *APIbank* has with end-users create a huge potential for the shift towards a value co-creation strategy. With one side of the platform being already present, the chicken-egg problem which is inherent to platform businesses (Caillaud/Jullien 2003; Evans/Schmalensee 2010) is basically solved. If third-party developers are allocated a share of the revenue that is created on the platform, the large customer base represents a huge incentive to participate in the platform. The project manager summarized this as follows:

> *"We have critical mass already. […] compared to start-ups, something like the Solaris Bank who were also offering banking as a service to start-ups. But their problem is that they can only offer a backend but they cannot offer customers. On our platform we have several million customers. The thing is that for our platform the external developers will be able to access […] all our customers. […] So, from a development perspective there is a million or whatever pool of customers potentially who would be customers for the application." (PM)*

5.4.3 Value Co-creation

Taken together, openness and collaboration lead to value co-creation on the API platform. The goal of *APIbank* is to co-create innovative solutions that the company would not be able to develop or that it would not have thought of. Access to complementary capabilities that third-party developers possess as well as the benefit from innovative ideas from outside of the company are the key reasons for *APIbank* to establish a value co-creation strategy:

> *"[…] you cannot do everything yourself. As a big company, we are simply not fast enough to come up with new innovative ideas and then in addition to that you find*

[…] start-ups that just focus on one piece of the value chain, they do really good. And I think that's also related to what customers perceive." (PT_2)

In addition to the fact that *APIbank* would not be capable of "doing everything", it would not always know what to do as the established structures and processes inhibit innovativeness. Relying on the crowd can yield many different ideas for complementary applications, some of them with great potential for success.

"If we just go outside, outside of [APIbank], people have ideas; people don't care about internal [APIbank] technology and how it gets managed and all. They just have ideas. So, I think there are so many people outside, crowd itself is innovative and let's say, if 10 people have ideas, one of them will be a really good one. So, the crowd itself is the innovative part. Not [APIbank] here because we build our own processes. We decide what is important for the customers and some other ideas showing up, and users they have other thoughts about it. They are not really interested in [APIbank's] processes." (PT_1)

Emphasizing a value co-creation strategy brings along areas of conflict and potential benefits.

Area of conflict – Threat to existing business. As *APIbank* has existing mechanisms of value creation, conflicts between those mechanisms and the newly introduced mechanism of value co-creation can arise. A third-party developer who creates a financial manager that helps users keep an eye on expenditures would not pose a threat to *APIbank's* key value propositions. It could even be a win-win situation as the financial manager could make the *APIbank's* online and mobile banking more attractive. A third-party developer that creates a peer-to-peer lending platform such as Lending Club using the open API would exclude the bank from the transaction of lending money and could therefore harm *APIbank's* existing mechanism of value creation.

"When we are partnering with others, we would like to understand their business model. […] we are looking for the business model if it is fine for [APIbank]. […] So, these criteria need to be defined by us." (PT_1)

This statement visualizes a tradeoff that *APIbank* faces when following a value co-creation strategy. On the one hand, openness should create a flourishing ecosystem of innovations while, on the other hand, potential harmful ideas should be avoided.

Area of conflict – Loss of access to customer. A second area of conflict arises from the fact that the applications based on the open API will most likely directly address customers, thus creating a competing channel to *APIbank's* channels to the customer. However, losing the touch point with the customer would make *APIbank* a pure technology provider that is not visible to the customer anymore and that is easily replaceable. The project team members have recognized this area of conflict:

"So, there are some critical strategic points, for example, we do not want to lose the central touch point with the customer or we must not lose it, let us put this way." (PT_3)

> *"[…] the business side, they are always afraid of providing the assets we earn money with to the other people, to other third parties so we might just go into the background and be a just a platform which going to be white-label-wise used by others." (PT_4)*

Potential benefit – Absorption of third-party developers. Established companies such as *APIbank* have often built up experience in acquiring smaller companies and integrating them into their processes and mechanisms of value creation. This experience can prove useful when shifting towards a value co-creation strategy. With this experience *APIbank* has the flexibility to observe the third-party developers while sharing revenue with them as long as promising acquisition options arise. These acquisitions not only strengthen *APIbank's* product portfolio but are also a way to find innovative and entrepreneurial employees (Fantasia 2016).

> *"And if there is a partner that delivers such a great value […] successfully to our customers, it would be an interesting question if we should buy him. […] we do have experts for that around. And I don't think that it should be a problem of not knowing of how to do that." (PT_3)*

This potential benefit can therefore mediate the threat that a value co-creation strategy poses to the established business of *APIbank*.

5.5 Discussion and Conclusion

In this section, we provide a summary of the areas of conflicts and potential benefits that established companies face when shifting towards a value co-creation strategy. Based on our insights from the exploratory case of *APIbank*, we enhance our theoretical pre-understanding.

5.5.1 Areas of Conflict and Potential Benefits for Established Companies

When defining the degree of openness for an IT platform, established companies need to consider that opening up might cause internal resistance as these companies traditionally exhibit hierarchical structures. Granting access to critical parts of the company's technology is another risk for the companies' businesses. At the same time, internal structures will need to be made transparent and, to a certain degree, standardized. Both can enhance the company's competitiveness and innovativeness (Ebner et al. 2009). When designing governance of collaboration on the platform, established companies might struggle to move their existing partners onto the platform and to convince innovative third-party developers to participate despite the established company's image of being too big and too slow. However, with the existing customers and partners, established companies have two assets that can have a major impact on the initial success of the platform. Existing customers incentivize third-party developers to join the platform and existing partners can act as sponsors that spread the platform. When constituting the mechanisms of value co-creation through the IT platform, established companies need to consider the impact of value co-creation on existing mechanisms of value creation and the threat of losing direct access to customers. However, the value co-creation also offers the opportunity to discover and absorb innovative complementary products or even the third-party developers themselves. The areas of conflicts and potential benefits enhance our understanding of how openness and collaboration facilitate value co-creation through IT platforms for established companies (Figure 8).

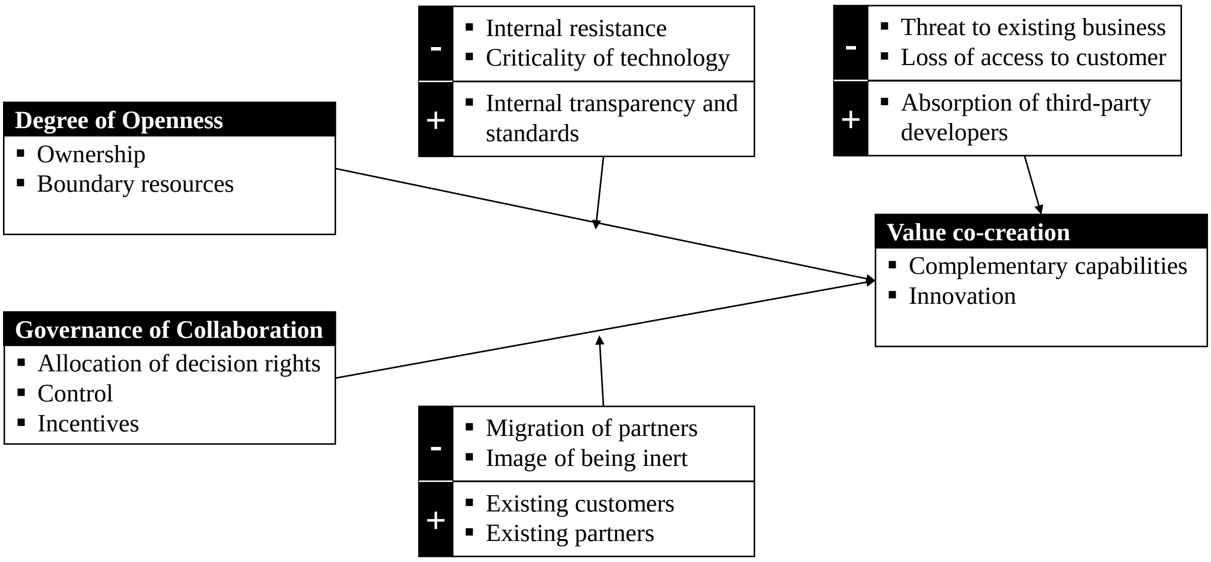

Figure 8. Revised Theoretical Understanding of Value Co-Creation Through Openness and Collaboration

Our results provide first starting points on how to mediate the areas of conflict and realize the potential benefits. First, the areas of conflicts and potential benefits can be addressed individually. For openness, the area of conflict related to internal resistance could be addressed by *"API evangelists"* (PT_2) that promote the API project internally and externally, and explain the potential benefits to doubters. For collaboration, a strategy needs to be developed how to manage existing partners, for example by providing them guidance on how to use the platform themselves or how to enhance the platform with additional APIs adhering to the same structures. To convince third-party developers to participate even though the platform is not initiated by a digital frontrunner, events such as hackathons can be organized (Leimeister et al. 2009).

Second, a fit between the degree of openness and the governance of collaboration contributes to solving the trade-offs related to value co-creation. In particular, to avoid the threat to the existing business and the loss of direct access to the customers, a careful alignment of openness and collaboration is necessary. While the case of Apple's app store is referenced several times by different interview partners, our results suggest that a digital marketplace with millions of applications and standardized relationships with the third-party developers might not be the most suitable approach for established companies. Given the fact that established companies do not need a high number of complementary products from the start as customers are already on the platform, it makes sense to initiate value co-creation with selected partners and gradually open up to further third-party developers depending on their intentions.

5.5.2 Contribution to Theory and Practice

With our revised theoretical understanding, we contribute to recent IS literature that focuses on openness of IT and value co-creation through collaboration via IT platforms. The organizing logic of open platforms has been promoted in literature for a while now (Sambamurthy/Zmud 2000; Fuentelsaz et al. 2015b) but insights for established companies have been scarce so far.

Our results show that the tension between openness and control inherent to platforms (Eaton et al. 2015; Ghazawneh/Henfridsson 2013) is particularly relevant for established companies that implement a value co-creation strategy. While boundary resources mediate this tension as shown by Eaton et al. (2015) and Ghazawneh/Henfridsson (2013), they are not sufficient to deal with existing partners that need to be moved onto the platform or with internal resistance to openness. Platform governance as discussed by Tiwana (2014) has proven to be a useful tool to facilitate value co-creation through digital platforms. We confirm that incentives, allocation of decision rights and control are key to governing collaboration on the platform also for established companies and we provide first insights on how governance can be implemented to cater to the specific situation of established companies. Our insights from one exploratory case need to be enhanced by more rigorous testing of, for example, the impact of different control modes in the context of established companies similar to the studies performed by Goldbach/Benlian (2014) or Goldbach/Kemper (2014) in the context of mobile app stores. By taking together our results on openness and collaboration for established companies, we contribute to an improved understanding of value co-creation via open IT platforms. We confirm that, following a resource-based view, established companies can benefit from open IT platforms by getting access to resources and capabilities of the third-party developers (Sarker et al. 2012; Thomas et al. 2014). However, due to the impact of the value co-creation strategy on existing mechanisms of value creation and customer relationships, the resource-based view alone is not sufficient to evaluate value co-creation. Future research on established companies that implement a co-creation strategy could also consider the transaction cost perspective or the dynamic capabilities perspective (Drnevich/Croson 2012). Finally, our results contribute to current IS literature on how the financial services industry is undergoing digital transformation and how it is responding to the trend of fintechs (Kelly 2014; Gaertner/Deutsche Bank AG 2015). Longitudinal studies of how fintechs interact with established banking companies that gradually open up would further increase our understanding.

In practice, our work firstly provides insights for banking companies that face specific challenges due to digitization, changes in customer preferences, and regulation (Mention et al. 2014). By showing potential benefits and areas of conflict deducted from a real case, we provide dimensions that need to be considered before engaging in open innovation activities with third parties. Not in every case, open innovation and co-creation will be the best solution nor does it provide answers to all challenges of the banking sector. Still, reflecting a banking company's situation in front of our findings helps to identify the right path. Secondly, numerous established companies from other domains consider a co-creation strategy or are in an early phase of implementing it. For example, the equipment manufacturer Trumpf has established a subsidiary, "Axoom" that is dedicated to creating a platform ecosystem around the machines Trumpf is manufacturing. For those companies, our work helps to evaluate the degree of openness on the technology level as well as governance strategies on the collaboration level. However, these companies need to consider that the findings are derived from the case of a banking company and need to be viewed in front of the own company's specific situation. Third, our findings can be adapted to further contexts where established organizations apply IT for collaboration, e.g. in e-government or non-profit work (Schreieck et al. 2016a).

5.6 Acknowledgment

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6 The Platform Owner's Challenge to Capture Value – Insights from a Business-to-Business IT Platform (P3)[13]

Title	The Platform Owner's Challenge to Capture Value – Insights from a Business-to-Business IT Platform
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Publication	International Conference on Information Systems (ICIS), 2017
Status	Published
Contribution of first author	Problem definition, research design, data collection and analysis, interpretation, reporting

Table 16. Fact Sheet Publication P3

Abstract

IS research has acknowledged the increasing importance of IT platforms. While substantial insights on value co-creation between the platform owner and complementors have been established, the platform owner's challenge to capture value remains largely unaddressed. We therefore conduct an exploratory field study of an enterprise software vendor who has launched a business-to-business IT platform. Conducting 27 interviews with actors involved in the platform ecosystem, we derive three distinct mechanisms of value capture: absorption, co-selling, and verticalization. We interpret how these mechanisms of value capture in turn affect value co-creation. With our results, we, first, enhance literature on value in IT platforms by adding mechanisms of value capture to the already established mechanisms of value co-creation. Second, we contribute to the discussion on the impact of digital business strategies on firm performance by showing that an organization that implements an IT platform needs to consider value co-creation and value capture jointly.

Keywords: Value capture, IT platform, platform ecosystem, value co-creation, platform owner

[13] The article is also provided in the Appendix in its original format.

6.1 Introduction

In today's hypercompetitive markets, firms no longer create value on their own or in dyadic relationships with supply chain partners. Instead, firms co-create value with partners as part of a fragmented interfirm network (Bitran et al. 2007; Pagani 2013). In order to benefit from value co-creation in their interfirm networks, firms need to capture a sufficient share of the value that is co-created (Rai/Tang 2014; Bharadwaj et al. 2013). As value co-creation and capture can affect each other in both reinforcing and alleviating ways, it remains a key challenge for firms to make most of the interfirm networks they are involved in (Lepak et al. 2007).

In the last decade, digital business strategies have emerged that rely heavily on IT to coordinate different actors participating in value co-creation (Bharadwaj et al. 2013). In particular, IT platforms supporting multisided digital business models have proven to enable value co-creation in interfirm networks (Grover/Kohli 2012; Venkatraman et al. 2014). IT platforms are IT artefacts that provide core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate (Baldwin/Woodard 2009; Boudreau 2007), thus they enable collaboration with partners and "unlock" the potential of a broader ecosystem of complementors (i.e., third-party developers) for value co-creation (Kuk/Janssen 2013; Zittrain 2006).

While value co-creation on IT platforms has been intensely studied during the last years, the platform owner's challenge to capture value is still poorly understood. We identify two main reasons why this is the case. First, the IS domain has predominantly focused on the effect of IT on value co-creation, for example the effect of improved coordination in supply chains through IT integration (Rai et al. 2006). Value capture is rarely considered as distinct mechanism alongside value co-creation – although this approach has been identified as relevant and promising in strategic management research (Lepak et al. 2007; Priem 2007). In research on IT platforms, for example, boundary resources (Eaton et al. 2015; Ghazawneh/Henfridsson 2013) and control mechanisms (Boudreau 2010; Tiwana 2015; Manner et al. 2013b) have been shown to contribute to value co-creation. However, it remains unclear what share of the co-created value accrues to the platform owner. Few distinct mechanisms of value capture have been identified such as pricing (Hagiu 2006; Tiwana 2014) and bargaining (Oh et al. 2015) between platform owner and complementors. These mechanisms have been derived from ideal platform models and may not sufficiently acknowledge the "complex and dynamic coordination across multiple companies" that is required in IT platforms (Bharadwaj et al. 2013, 478).

Second, in digital business strategies, value is captured from interfirm networks, thus value capture mechanisms might in turn affect the ongoing value co-creation in the interfirm network (Bharadwaj et al. 2013; Rai/Tang 2014). In the context of IT platforms, value capture refers to claiming parts of the value that is co-created within the platform's ecosystem (Venkatraman et al. 2014). This requires mechanisms that let platform owners claim a share of the value in the interfirm network without alleviating value co-creation. For example, the platform owners can provide boundary resources to their partners to enable them to co-create value, while claiming a certain share of their revenue (Eaton 2012). As the share the platform owners claim gets bigger, the partners' incentives to co-create decrease. This interaction is raised in literature on IT platforms (e.g., Tiwana 2014), but has rarely been analyzed for distinct mechanisms of value capture. Our overall research objective is therefore *to develop an empirical understanding of the mechanisms platform owners apply to capture value from IT platforms and how these mechanisms in turn affect value co-creation.*

Towards this end, we conduct an exploratory case study of an enterprise software vendor who has launched a business-to-business (B2B) IT platform. This case is particularly suited to explore value capture, as the platform owner *IS-Corp* (anonymized) is an established, successful organization that has already gathered significant experience in implementing IT platforms. Based on the explorative case study, we observe a variety of measures taken to capture value from the IT platform. We classify the observed measures into three mechanisms of value capture: absorption, co-selling, and verticalization. We describe these mechanisms along with their manifestations and interpret their interaction effects on value co-creation.

With our results, we contribute to the understanding of how IT platform ecosystems generate value and how the different actors of the ecosystem share the generated value. This has implications for the ongoing debate of openness and control of IT platforms and informs the more general discussion of the performance of digital business strategies that are based on interfirm relationships (Bharadwaj et al. 2013). Our insights furthermore inform platform owners in their challenge to establish sustainable IT platforms.

6.2 Theoretical Background

As recommended for exploratory case studies, we develop a theoretical pre-understanding of value capture in IT platforms (Walsham 1995). This covers extant work on value co-creation and capture as distinct mechanisms as well as the current state of knowledge on value capture in IT platforms.

6.2.1 Value Co-creation and Value Capture as Distinct Mechanisms

To stand their ground in today's hypercompetitive markets, firms can no longer solely rely on their own resources and capabilities but need to collaborate with partners to leverage their resources and capabilities (Ferrier et al. 2010; Tanriverdi et al. 2010). Consequently, the locus of value creation has shifted from the single firm to supply chains and, more recently, to interfirm networks that may be complex and fragmented (Peppard/Rylander 2006; Bitran et al. 2007; Pagani 2013). This shift in the locus of value creation corresponds to management researchers moving from the resource-based view (Wernerfelt 1984; Barney 1991) towards a relational view of the firm (Dyer/Singh 1998). To benefit from the interfirm relationships in these networks, firms need to address a twofold challenge: (1) co-creating value by aligning decisions, resources and activities with their network partners (Im/Rai 2014; Rai/Tang 2010; Grover/Kohli 2012) and (2) capturing a sufficient share of the value that is co-created within the interfirm network (Bharadwaj et al. 2013).

To outline this twofold challenge, we first clarify our understanding of the terms value, value co-creation, and value capture. We interpret *value* as exchange value, "the amount the consumer actually pays, representing revenue to a value system" (Priem 2007, p. 220, based on Bowman and Ambrosini 2000) . The term value system in that definition illustrates that the recipient of the exchange value is not necessarily a single firm but can also be an interfirm network that co-created the value the customer pays for. With *value co-creation*, we broadly refer to the collaboration between multiple stakeholders (Ranjan/Read 2016). This understanding of value co-creation goes beyond co-creation with customers, a view coined in marketing literature (Chen et al. 2012; Prahalad/Ramaswamy 2000; Zwass 2010). Our understanding explicitly considers other organizations as partners for value co-creation, a view established in IS research (Lempinen/Rajala 2014; Schreieck/Wiesche 2017; Venkatraman et al. 2014; Sarker et al. 2012; Han et al. 2012). In particular, complementors of a platform ecosystem can be partners for value co-creation (Smedlund 2012). In line with that, we refer to *value capture* as "the appropriation and retention […] of payments made by consumers in expectation of future value from consumption" that one member of a value system can claim for itself (Priem 2007, 220).

The twofold challenge of value co-creation and value capture has been acknowledged in management research on value creation, but Lepak et al. (2007) and Priem (2007) note that still many studies do not distinguish processes of value creation (such as value co-creation in the case of interfirm networks) and value capture. For example, the relational view of the firm identifies determinants for relational rents in interfirm relationships but does not clarify how these rents are shared among the partners in the interfirm relationship (Dyer/Singh 1998). Consequently, understanding and optimizing value co-creation in an interfirm network does not necessarily increase the focal firm's market performance – value capture has to be considered along with value co-creation (Bowman/Ambrosini 2000). As a rule of thumb, however, an increase in value co-creation leads to a better initial position for value capture. This relation is stronger, the better the focal firm's bargaining position vis-à-vis co-creation partners (Bowman/Ambrosini 2000). The differentiation of value co-creation and value capture can be crucial in situations where value is successfully co-created but a participant struggles to capture a sufficient share. For example, suppliers in the automotive industry nowadays play an important role in creating innovation together with the car manufacturers. Due to the strong market positions of the manufacturers, suppliers are in a difficult bargaining position to capture their share of the value created by the innovation (Prahalad/Ramaswamy 2000). Furthermore, there are situations in which value is co-created but some actors do not aim at capturing value as for example in open source communities (Shah 2006) or in non-profit organizations (Schreieck et al. 2017b).

According to IS research, IT plays a crucial role in value creation of firms. In particular in today's complex interfirm networks, IT has become a central element of digital business strategies that include value co-creation within interfirm networks and value capture of different actors in the network (Bharadwaj et al. 2013). Thereby, IT as part of a digital business strategy can alter existing mechanisms of value co-creation and capture and introduce completely new mechanisms (Chen et al. 2010; Venkatraman et al. 2014). However, as digital products and services merge with the underlying IT infrastructure (Bharadwaj et al. 2013; El Sawy 2003), it becomes more difficult to identify the mechanisms of value creation and to distinguish between value co-creation and value capture as constituent parts of value creation. Similar to Lepak et al. (2007) in management research, Bharadwaj et al. (2013) state that differentiating value co-creation and value capture while considering their interplay will potentially bring our understanding of digital business strategies and their impact on the performance of IT platforms forward.

6.2.2 Value Capture in IT Platforms

Implementing IT platforms represents a digital business strategy enabled by new technological means such as cloud computing or in-memory databases (Bharadwaj et al. 2013). We define IT platforms as "the extensible codebase of a software-based system that provides core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate" (Tiwana et al. 2010, 676). Due to their extensible nature, IT platforms enable the platform owner to collaborate with partners to "unlock" the potential of a broader ecosystem of complementors for value co-creation (Kuk/Janssen 2013; Ondrus et al. 2015; Zittrain 2006). Thereby, IT platforms facilitate a multisided business model that brings together complementors on the one side and end-users on the other side. Taken together, we refer to the IT platform, its interfaces and complementary applications, and the platform's stakeholder as platform ecosystem. The terminology related to IT platforms that represents our understanding in this study is summarized in Table 17.

Term	Definition	Sources
IT platform	"[T]he extensible codebase of a software-based system that provides core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate."	Tiwana et al. (2010, 676); see also (Baldwin/Woodard 2009)
Application (app)	An add-on software subsystem or service that connects to the platform to add functionality to it. Also referred to as a module, extension, plug-in, or add-on.	Parker et al. (2017); Tiwana (2014)
Interfaces	Specifications and design rules that describe how the platform and applications interact and exchange information.	Tiwana (2014)
Platform owner	An individual or organization representing the legal entity that owns the platform.	Tiwana (2014); Evans et al. (2006)
Complementor	Individuals or organizations that develop one or more applications for the IT platform (also referred to as third-party developers).	
End-user	Individuals or organizations that use the applications available on the IT platform.	
Platform ecosystem	The platform and the applications specific to it as well as the stakeholders of the platform. Also referred to as platform-based software ecosystem, or software ecosystem.	Cusumano/Gawer (2002); Tiwana (2014)

Table 17. Definition of Key Terms in the Context of IT Platforms

Existing research on IT platforms has predominantly aimed at explaining how IT platforms enable value co-creation between the platform owner and the complementors (Schreieck et al. 2016b). For example, it has been found that boundary resources, that is, resources the platform owner provides to facilitate the development of complementary applications, stimulate value co-creation (Ghazawneh/Henfridsson 2013; Eaton et al. 2015). A balance of openness and control is required to optimize value co-creation (Boudreau 2010; Ghazawneh/Henfridsson 2013; Hein et al. 2016). However, value co-creation and value capture need to be combined in a cross-pollinating way to bring an IT platform forward (Ceccagnoli et al. 2012). The provision of boundary resources can be costly and thus impede value capture despite its positive effect on value co-creation. Similarly, increasing openness of a platform ecosystem can spark value co-creation but may also weaken the position of the platform owner to capture value. To understand how a digital business strategy such as implementing an IT platform is successful, it is necessary to identify and understand mechanisms of value capture as well as interaction effects between value capture and value co-creation.

To complicate matters, the notion of value capture in IT platforms differs from the more general strategic management interpretation of value capture as appropriating value from a market (Lepak et al. 2007; Lippman/Rumelt 2003). In the context of IT platforms, value capture refers to appropriating value from the overall value that is co-created in the collaboration of the platform owner with the platform's complementors (Huang et al. 2012). As a result, insights from management research that revolve around "isolating mechanisms" are not applicable for value capture within IT platforms. Isolating mechanisms represent barriers to imitation that preserve profits in the face of competition. While these mechanisms might be relevant in competition between different IT platforms, they do not address the challenge of capturing value from the interfirm relationships within the platform ecosystem.

More recently, research on IT platforms has acknowledged the importance of value capture and provides first insights on how platform owners can maximize value capture. Considerations on pricing (Hagiu 2006; Tiwana 2014) and bargaining (Oh et al. 2015) help platform owners to configure revenue sharing with complementors in their favor. However, value capture in IT platforms goes beyond cashing a certain percentage of the complementors' revenue. For example, the absorption of complementary solutions (Parker et al. 2017; Eisenmann et al. 2009) or the investment in selected complementary products (Rietveld et al. 2016) have been laid out as possible mechanism of value capture. With the notable exception of (Rietveld et al. 2016), we lack empirical understanding of the mechanisms of value capture, as most results are derived from idealized models of large-scale platforms. Some IT platforms such as Google's Android come close to these models but the majority of IT platforms, particularly in the B2B context, are more heterogeneous and complex, changing also the context for value capture. For example, it remains unclear, how the degree of openness – a key decision to be made when implementing an IT platform (Ondrus et al. 2015) – is related to value capture.

In sum, IS research provides us with a good understanding of value co-creation in IT platforms, but lacks insights on mechanisms that enable value capture along with their interaction effect on value co-creation. Figure 9 locates value capture in IT platform ecosystems alongside value co-creation and Figure 10 illustrates the focus of our study based on our theoretical pre-understanding of value capture in IT platforms:

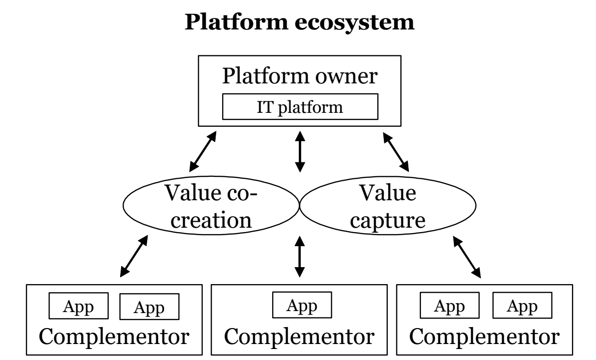

Figure 9. Value Co-Creation and Value Capture in IT Platform Ecosystems

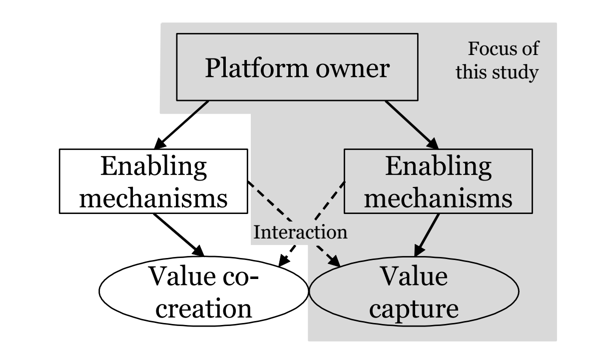

Figure 10. Theoretical Pre-Understanding of Value Capture in IT Platforms

6.3 Research Design

In this section, we describe our case organization and the explorative case study approach we adopted. An exploratory case study is suitable for several reasons. First, the subject of our study, firms that engage in IT platforms as digital business strategy, is complex and dynamically evolving. It is thus advisable to study this phenomenon in its context with an iterative interplay of data collection and analysis. Second, the theory gap of value capture we identified is worthwhile to be researched with an explorative, inductive approach. Due to the heterogeneous and young field of platform theories, developing a theoretical framework and formulating hypothesis upfront is hardly feasible (Urquhart et al. 2010; Schreieck/Wiesche 2017).

6.3.1 Case Description

IS-Corp is a multinational software company focusing on enterprise software solutions. In this study, we focus on one of *IS-Corp's* core products, an enterprise software used in various industries and companies of different sizes. To develop and market this software, *IS-Corp* collaborates with a large network of partners. As customers expect the software to be an end-to-end solution that covers all relevant business processes, *IS-Corp* faces a merely infinite number of heterogeneous requirements across industries and countries. The software needs to consider characteristics of industry-specific processes as well as country-specific regulations such as fiscal laws. Consequently, *IS-Corp*, just as most enterprise software vendors, relies on partners that fill white spaces in the product portfolio, localize products, or support global sales activities (Grabski et al. 2011; Sarker et al. 2012). Thus, *IS-Corp* collaborates with various other software companies, IT providers, and IT consultancies. With the latest version of the enterprise software product that we analyze in this study, *IS-Corp* aims at opening the software to a large number of third-party developers by establishing an IT platform for third-party extensions (we refer to this platform as the "*IS-Corp* platform").

With its platform strategy, *IS-Corp* leverages the possibilities created by the advance of cloud computing. Cloud computing refers to the rapid provisioning of on-demand access to a pool of configurable computing resources such as networks, servers, storage, applications, and services (Mell/Grance 2011). As the performance of networks, servers, storages, and database technologies has increased continuously over the last years, it is now possible to provide larger enterprise software solutions via cloud computing. For example, large amounts of business data can nowadays be processed in real-time with in-memory database technologies. *IS-Corp* leverages cloud computing not only to make its own software more flexible and powerful, but also to facilitate the development of third-party applications. With its cloud-based *IS-Corp* platform, it provides application programming interfaces (APIs) that grant developers access to functions such as production data analysis. Third-party developers can utilize these APIs and the accompanying software development kit (SDK) to extend the business applications provided by *IS-Corp* or to develop new ones. As a result, an ecosystem of extensions to *IS-Corp's* enterprise software solution arises (see Gawer 2014 and Tiwana et al. 2010) . Customers can download these extensions via a marketplace and deploy them rapidly, even during run-time.

The case of the *IS-Corp* platform is of particular interest for our study of value capture in IT platforms for several reasons. First, *IS-Corp* has experimented in the past with IT platforms and includes its lessons learned on value co-creation and capture in the current IT platform setup.

Second, the project of the IT platform is central to *IS-Corp's* strategy. The firm is committed to the project and assigned sufficient resources. Finally, the *IS-Corp* platform represents a business-to-business (B2B) IT platform: both third-party developers and end-users represent firms. Analyzing this case allows us therefore to extend our understanding of value capture that, up to now, has been derived from business-to-consumer (B2C) IT platforms such as Google's Android that have a much larger base of end-users (e.g., Boudreau 2012; Ghazawneh/Henfridsson 2013; Goldbach/Benlian 2014).

6.3.2 Exploratory Case Study

To close the theory gap of value capture in IT platforms, we conducted an exploratory case study (Yin 2014; Walsham 1995). Taking on an interpretivist stance (Conboy et al. 2012; Goldkuhl 2012), we collected qualitative interview data and adopted a grounded theory approach (Glaser/Strauss 1998; Urquhart 2013) for coding and interpreting the data. As described below, we followed the grounded theory methodology procedures for data collection and analysis as summarized by Wiesche et al. (2017).

The selection of our case and our interview partners followed theoretical sampling considerations (Urquhart et al. 2010). Our case company needed to have an established way of co-creation value with partners on an IT platform, which it uses to capture value through different mechanisms, both being the case for *IS-Corp*. We started selecting interview partners that could describe the process of value co-creation and iteratively chose new interview partners to shed more light on value capture processes (Walsham 1995). We conducted semi-structured interviews with employees and externals involved in the *IS-Corp* platform project in different positions following the guidelines by Gläser/Laudel (2009). In total, we conducted 27 interviews with 29 interview partners between February 2016 and February 2017. The interviews lasted 58 minutes on average. The interview questions covered the history of the platform project, the processes of value co-creation and capture, and the interviewees' assessment of the platform project. We provide details on the interview partners and exemplary interview questions in Table 18.

Throughout our data collection and analysis, our focus was on discovery of concepts and relationships in the context of value co-creation and value capture (Urquhart/Fernandez 2006). We did not aim at deductively testing relationships between value co-creation and value capture that authors have discussed in prior literature. The theoretical background we provided above rather helped us to contour our research project and to motivate our study.

***IS-Corp* (19 interviews; 21 interview partners)**	
Interview partners ▪ High level managers responsible for the *IS-Corp* platform (e.g., project lead, chief architect, product owner) ▪ Employees that worked with the same software product before the introduction of the *IS-Corp* platform and could thus report on the changes inflicted by the platform strategy ▪ Relatively new employees that had gathered experience in platform projects at other companies	*Exemplary interview questions* ▪ "What are the core features of the *IS-Corp* platform?" ▪ "Can you describe the history of the *IS-Corp* platform project?" ▪ "In what ways are third parties involved in the *IS-Corp* platform?" ▪ "What is *IS-Corp's* business model behind the platform?"
Partners (8 interviews)	
Interview partners High level counterparts of *IS-Corp* within three different partner companies that offer specialized extensions of the *IS-Corp* platform: ▪ A software vendor (> 1,000 employees) with a focus on lifecycle management and go-to-market analyses ▪ An IT service provider (> 5,000 employees) with a focus on the financial industry ▪ A software vendor (> 10,000 employees) with a focus on solutions for enterprise content management	*Exemplary interview questions* ▪ "What is your company's motivation to contribute to the *IS-Corp* platform ecosystem?" ▪ "Can you describe the collaboration with *IS-Corp*?" ▪ "What resources does *IS-Corp* provide to support your development of complementary applications?" ▪ "What is your company's business model behind the collaboration with *IS-Corp*?"

Table 18. Details on Interview Partners and Interview Questions

For the coding process we followed the Glaserian approach (Glaser/Strauss 1998; Urquhart 2013). We illustrate our coding scheme in Table 19. We started with open coding and created 502 codes associated with 703 interview quotes. In axial coding, we identified 42 subcategories that summarized open codes related to the same aspect of value capture or to a positive or negative consequence of value capture. We clustered these subcategories to 12 categories that describe different manifestations of value capture as well as interaction effects on value co-creation. Subsequently, we conducted selective coding to relate the categories to specific mechanisms of value capture and to link those to our theoretical pre-understanding. Following the principle of constant comparison (Urquhart et al. 2010), we returned to the data whenever a relationship emerged in the selective coding to verify its grounding in the data. By using 24 memos in the process of coding, we captured ideas on concepts and their relationships early in the analysis (see Gregory et al. 2015).

Interview statement and open coded sections	Subcategories	Categories
"We paid attention that the [acquired solution] can be easily integrated in our platform.[1)] There are often scenarios, when a customer or a partner says, [the acquired solution] is great, but there is a certain piece missing. […] then you need some kind of platform that allows them to fill this gap[2)]. This is always our biggest selling point, that we can say we have integrated [the acquired solution], with our platform, you can use it in an easier way.[3)]"	1) Integration of acquired solutions 3) Benefit of acquiring solutions	Acquisition
	2) Customer adding functionality to the software 3) Platform facilitates additions by customers	Customer enablement
"[…] we continue to be the developer of the application, but it is marketed as [IS-Corp-]branded product[4)]. [IS-Corp] sells the software not as [third-party application], but just as if it was an [IS-Corp] software. […] Since this is happening, revenues with [IS-Corp] have increased steadily.[5)]"	3) Marketing third-party product under *IS-Corp* brand	Branding
	4) Partner revenue increase	Positive effect on value co-creation

Table 19. Illustration of the Coding Scheme

6.4 Findings and Interpretation

The analysis and interpretation of our interview data helped us, first, to confirm that the *IS-Corp* platform contributes to value co-creation and capture. Second, we analyze the interview partners' views on value capture. Combining and interpreting these views leads to the emergence of three mechanisms of value capture implemented on the platform. Third, we are able to further interpret the interaction effect of the value capture mechanisms on value co-creation.

6.4.1 IT Platform Supporting Interfirm Collaboration

Our findings first confirm that collaboration with partners on the IT platform is key to *IS-Corp's* business. The enterprise software product we focus on is extended by various applications developed by partners. This collaboration is a *"win-win situation"* for both *IS-Corp* and its partners, as interview partners form both sides confirmed. Partners help *IS-Corp* to offer end-to-end solutions for customers across industries and countries. Specialized third parties can provide offerings that require specific knowhow or address a relatively small niche market in a more efficient way.

In addition, the partners benefit from collaborating with *IS-Corp* on the IT platform, by gaining access to the large market that *IS-Corp* has been addressing with its enterprise software. Application partners do not need to set up worldwide sales channels; they can directly market their application to *IS-Corp's* installed base and to new customers via the *established* sales channels. Thereby, they also benefit from *IS-Corp's* positive image for reliable software solutions. On the technological layer, the collaboration of *IS-Corp* and its partners is enabled by an increasingly open architecture that provides APIs and is based on common programming languages. One interview partner of *IS-Corp* states:

> *"[IS-Corp] attracts partners relatively easy. As of today, we have several hundred partner applications running – probably even more – [developed by] application providers from different segments. This is a relatively steep growth curve, [the number of] our partners. This is also related, for example, to our shift from a solution that was coded in [proprietary language] and now is designed much more open with Java. Deploying and integrating your applications with Java is significantly easier now."*

Thus, while in earlier versions of the software product few strategic partners developed deeply integrated extensions to the core system, with the new *IS-Corp* platform, numerous platform partners can develop extensions with significantly less effort. The product manager refers to the platform as the *"innovation layer for the traditional, rather slow ticking systems of [IS-Corp]."* He further describes that *IS-Corp* had initially focused on value co-creation, aiming at enlarging the network of third-party developers and the number of available solutions:

> *"You have to make the pie bigger by bringing more partners on the platform and by thinking about new use cases, scenarios, or applications that are not covered yet."*

However, it is not just the size of the pie that determines the success of the platform project, but also the share of the pie that *IS-Corp* can claim. Whether an organization is successful with a digital business strategy such as the implementation of an IT platform depends on both a flourishing ecosystem for value co-creation and a suitable approach for value capture. In the context of the *IS-Corp* platform, there are no longer contractual agreements on value sharing as it was the case in dyadic partnerships. Value co-creation is not automatically associated with value capture. Consequently, the product manager sees a deficit despite an increasing number of third-party extensions: *"If you also consider the revenue [of the IS-Corp platform], we lack behind. We should have come further. Are there initiatives [to improve that]? Yes."* We discuss the initiatives that *IS-Corp* has taken to improve the value captured from its platform in the next section.

6.4.2 Mechanisms of Value Capture

In the course of the analysis and interpretation of the interview partners' views on value capture, three mechanisms of value capture emerged: (1) absorption, (2) co-selling, and (3) verticalization. Each mechanism becomes manifest in different actions of value capture as summarized in Table 20. While these manifestations directly result from the analysis of the interviews, the three mechanisms are a result of our interpretation of the findings.

Mechanism	Description	Manifestations
Absorption	The platform owner extends the product portfolio by providing complementary applications or functionalities that formerly were offered by third parties.	▪ Acquisition of third-party applications or the firms behind the applications ▪ Imitation of third-party applications ▪ Extension of the platform's core offering covering functionalities previously provided by third parties
Co-selling	The platform owner engages in joint activities with third-party developers to support them in selling their applications.	▪ Bundling of third-party applications and platform ▪ Branding & certification of third-party applications ▪ Customer enablement to support customers in marketing applications they developed for their own use
Verticalization	The platform owner defines and, together with partners, implements dedicated vertical use cases on the platform.	▪ Industry verticals to address specific industries with a pre-defined set of platform functionalities and third-party applications ▪ Front-runners to illustrate the platform's potential in industry verticals early on

Table 20. Mechanisms of Value Capture

The mechanism **(1) absorption** refers to activities *IS-Corp* engaged in to directly offer complementary applications to end-users that previously had been provided by third-party developers. As *IS-Corp* absorbs these applications, it can claim the full revenue resulting from the applications' sales, instead of sharing the revenue with third-party developers. The mechanisms of absorption emerged from our data, as our interview partners mentioned diverse actions related to absorbing complementary applications. We grouped these actions into three main manifestations, which we describe in more detail below: acquiring third-party applications (or the firms developing the applications), imitating other third-party applications or extending the core of the platform with functionality previously provided by third-party applications.

IS-Corp has acquired a number of firms whose products it now offers as complementary applications on the *IS-Corp* platform. These firms did not necessarily have a complementary application on the platform before the acquisition, but they had products *IS-Corp* could transform into complementary applications. For example, *IS-Corp* bought a firm that offers solutions for human resource management. By acquiring the firm and moving the solutions on the *IS-Corp* platform, *IS-Corp* increased the number and variety of applications available on its platform. The absorption of these applications therefore has a direct and an indirect effect on value capture. The direct effect results from the applications' sales on the platform that accrue to *IS-Corp* entirely. The indirect effect results from an increased number of innovative applications that make the platform more attractive. The project lead of the platform project illustrates the potential of carefully chosen acquisitions that *IS-Corp* subsequently makes available on the platform:

> *"We paid attention that the [acquired solution] can be easily integrated in our platform. There are often scenarios, when a customer or a partner says, [the acquired solution] is great, but there is a certain piece missing. […] then you need some kind of platform that allows them to fill this gap. This is always our biggest selling point, that we can say we have integrated [the acquired solution] with our platform, you can use it in an easier way."*

From *IS-Corp's* experience, it is easier to acquire a firm that provides a complementary application on the platform than a firm whose product is going to be integrated into *IS-Corp*'s core product. The firm with a complementary application can run relatively autonomously after the acquisition, acting like an independent third-party developer. This reduces typical frictional losses that occur when the new parent company quickly integrates acquired firms.

> *"Usually, you let [the acquired firms] run autonomously for a certain time. […] Otherwise, you destroy all the advantages you gain from acquisitions. Just as [anonymized company]. They are still quite autonomous and they have been with us for several years – and still have high degrees of freedom."*

Besides acquiring complementary applications, we identified two less explicit strategies of absorption: imitating existing applications and integrating parts of their functionality in the platform's core offering. Similarly to acquisition, both actions affect value capture directly, by generating revenue that does not need to be shared and indirectly by strengthening *IS-Corp's* position in the competition. One of *IS-Corp's* partner managers states the importance of the own core offering on the platform:

> *"Internally, it is fact that innovative and promising applications on the [IS-Corp platform] often are generated by us."*

By engaging in **(2) co-selling**, *IS-Corp* collaborates with third-party developers in joint sales activities. This collaboration goes further than just offering the third-party applications on the app store of the platform. The goal of joint sales activities is that *IS-Corp* helps to increase the third-party applications' sales and, in turn, claims a larger share of the revenue. Therefore, co-selling activities potentially increase *IS-Corp's* value captured from the platform ecosystem.

Interview partners from both *IS-Corp* and partners highlighted the benefit of joint sales activities. We grouped the specific actions taken to leverage joint sales activities for value capture into three facets of co-selling: bundling, branding and certification, and customer enablement.

Bundling refers to deals in which end-users purchase a bundle consisting of the platform and one or several applications. Bundling is particular important in a B2B context. Most sales deals are closed because of direct interaction between the sales team and the end-user – despite most applications being available in the platform's app store. As the platform alone is not relevant for most customers, *IS-Corp* needs to suggest a suitable combination of platform and apps to the customers:

> *"There are always these cross-selling and bundle deals where we sell some kind of standard product which generates considerable revenue for the sales guy. We realized that with regard to the [IS-Corp platform]: in the beginning, we did not tell the [platform] story right. We did have a marketplace and all, but that just didn't work for our company, just because our customers do not buy on an online marketplace. Instead, they have their person of trust in our sales team, whom they have confidence in, whom they buy bundles from. […] There's our sales guy saying `dear [customer], I offer you these three packages and if you take the fourth, it's 50% off.´ That's how our deals are closed."*

Most third-party developers would not be able to sell their applications as much, if it was not for *IS-Corp* and its sales teams. As a result, *IS-Corp* can claim a substantial share from the revenue generated through third-party applications in such bundle deals, increasing its value captured form the platform ecosystem.

As further facet of co-selling, branding and certification sparked our interest. By branding, we refer to complementary applications of the platform that were developed by third parties but are marketed under the *IS-Corp* brand. Branding does not entail that third-party developers did subcontracted development for *IS-Corp*. Instead, once the third-party developers approached *IS-Corp* for marketing their applications, both concluded that marketing the application under the *IS-Corp* brand is most beneficial. The reason could be that the third-party developers need endorsement by the *IS-Corp* brand, as not all end-users know them. At the same time, *IS-Corp* sees the advantage of remaining visible to the end-user as provider of the front-end functionality. By marketing applications under its own brand, *IS-Corp* guards against being seen as pure technology provider while others offer the innovative applications on top of the technology.

Certification is similar to branding but does not go as far. Instead of rebranding the third-party applications, *IS-Corp* certifies them and labels them accordingly. Again, the motivation for third-party developers is to benefit from *IS-Corp's* image and from its extended support in sales activities for certified applications. *IS-Corp* can increase its value capture through certification in a twofold way. First, third-party developers pay for being certified, creating direct revenue for *IS-Corp*. Second, certified applications are increasing the overall sales of applications as end-users are more likely to trust them. Therefore, the value captured through revenue share also increases for *IS-Corp*.

A third facet of co-selling we observed is customer enablement. By customer enablement, we understand supporting customers to develop and subsequently market an application that the customers need for their own use. Many firms that are end-users of *IS-Corp's* enterprise software use the platform to develop applications for their own purposes, for example, to analyze data sets that only result from processes in a specific industry and have specific characteristics. The product owner of the *IS-Corp* platform illustrates:

> *"One of our largest and dearest customers by now has developed four applications on [our platform]. They built a CRM application, on [our platform], they built a call center application, on [our platform] - as extensions to their on-premises system. They were one of the firsts to do so."*

IS-Corp does a lot to enable these customers to develop the applications they need. For example, *IS-Corp* offers trainings on how to use the platform to develop individual applications or consults customers on specific projects. *IS-Corp* has started to evaluate whether some of these applications developed by customers were relevant for other customers as well and could thus be marketed on the platform. To do so, *IS-Corp* needs to enable the customer to develop the application in a generic way so that it can be white-labelled and sold to others. *IS-Corp* would increase its value captured beyond the fees the customer pays for using the platform by generating additional revenue through white-labelled customer applications.

(3) Verticalization refers to the platform owner defining and implementing dedicated vertical use cases on the platform to increase the platform's acceptance among customers. The *IS-Corp* platform is of horizontal nature, following the basic idea of a platform to support applications for various use cases. However, in a B2B context, generating solutions for specific use cases based on a horizontal platform is challenging. For example, in equipment manufacturing, a heterogeneous machine outfit combined with complex processes leads to specific requirements for the platform and its extensions. It is unlikely that generic applications designed for the horizontal platform will fulfill these requirements.

To address this challenge, *IS-Corp* defines specific industry use cases, i.e., "industry verticals" that bring together the stakeholders involved in such complex processes. For example, *IS-Corp* connects the manufacturers of the machines used at the customer sites for production as well as application partners that are able to provide suitable analytics applications. *IS-Corp* consults the stakeholders of the industry verticals on how they can leverage the platform to develop applications useful for the specific industry. The project lead of the platform describes one particular initiative for an industry vertical:

> *"At [our customer] we have an application, [our customer] is using it, it analyzes vibration of machinery, meaning, the different machines are connected via [our platform], provide measurement data and, based on this data, conduct vibration analyses to anticipate outages of the machines. And then you can schedule maintenance even before the outages occur, that's an easy way to reduce costs, minimize maintenance costs and minimize downtime"*

By creating dedicated industry verticals, *IS-Corp* unlocks new markets for its platform that are considered too specialized to benefit from a horizontal platform. As *IS-Corp* is initiating these industry verticals, it is in a good position to claim a considerable share of the revenue generated from the applications within the verticals. While creating a vertical requires some upfront investments, selling them to several end-users will soon lead to profits due to economies of scale.

Closely related to the manifestation of industry verticals are front-runners. Front-runners are third-party developers that provide complementary applications as early as the start of the IT platform or of a dedicated industry vertical. On the one hand, those front-runners can be existing strategic partners of *IS-Corp*. Ideally, these strategic partners are reputable in their respective industry and thus incentivize others to also contribute applications to *IS-Corp* platform. One external partner of *IS-Corp* describes this signaling effect:

> *"[…] just like Netflix when, at the time, they used Amazon for their [streaming service]. It is important that there are other companies, renowned firms, that use the service, that illustrate the use case."*

On the other hand, large strategic partners may be relatively slow and might not come up with the most innovative solution for the start of the platform. Collaboration with smaller partners as front-runners can therefore also be beneficial, as the product owner of the platform states:

> *"What you need is indeed some kind of front-runners that, in the end, influence others to copy their moves. And that's why [IS-Corp] would be ill-advised to only collaborate with large strategic partners on the platform. Instead, we also […] conduct co-innovation with smaller partners early on."*

Front-runners are therefore essential for *IS-Corp* not only at the launch of the platform but also at the launch of industry solutions such as the *IS-Corp* platform for the Internet of Things (IoT). They demonstrate the potential of the platform for others, thus *IS-Corp* is in a good position to establish a beneficial revenue sharing model already from the beginning. Taken together, verticalizing the horizontal platform has the potential to create new revenue streams from which *IS-Corp* can claim a substantial share.

6.4.3 Interaction Effects on Value Co-creation

The insights on the mechanisms of value capture – absorption, co-selling, and verticalization – cannot be presented without discussing their interaction effects on value co-creation. Value capture can have reinforcing and alleviating effects on value co-creation, which would then require a careful balancing between increasing value co-creation and smothering value capture. By interpreting our findings, we suggest interaction effects of the three mechanisms with value co-creation as summarized in Table 21.

Mechanism	Interaction Effect on Value Co-Creation	Illustration
Absorption	**Negative (-):** As the platform owner absorbs complementary applications from third parties, their incentives to contribute further complementary applications are decreased.	*IS-Corp* has acquired several companies in the areas of procurement and human resource management, whose products are moved onto the platform. This restricts the potential value co-creation in those areas.
Co-selling	**Positive (+):** As the platform owner supports third-party developers in their sales activities through different facets of co-selling, their incentives to contribute further complementary applications are increased.	Several partners of *IS-Corp* have stated increasing revenues due to co-selling activities, leading to an overall positive effect on value co-creation in the ecosystem.
Verticalization	**Neutral (o):** As the platform owner creates dedicated industry verticals, new areas for value co-creation are made accessible. At the same time, the increasing specialization in verticals shrinks the target group, decreasing third parties' incentives to contribute further complementary applications.	*IS-Corp* provides industry-specific solutions, for example for the manufacturing industry. Value co-creation takes place with partners, for example for applications to manage tooling of machines. This specialization entails limited co-creation opportunities across use cases on the platform.

Table 21. Mechanisms of Value Capture and Their Interaction Effect on Value Co-creation

First, we suggest that the mechanism of absorption in general has a negative impact on value co-creation. To establish sustainable value co-creation activities on a platform, incentives for third-party developers are necessary. Commonly, the main incentive for third parties to develop applications is that they can reach a large number of platform users with far less effort compared to a situation where they would need to market their software product on their own. Even though in the case of *IS-Corp* the addressable market is smaller than in many B2C platform markets (e.g., smartphone operating systems and their mobile applications), being able to sell applications to all of *IS-Corp's* customers is a promise of high returns for many third-party developers.

However, if *IS-Corp* internalizes successful or promising third-party applications to claim the full revenue, this can negatively affect the third-party developers' motivation. In particular, if *IS-Corp* imitates third-party applications or extends the functionality of the platform core making third-party applications redundant, third-party developers incentives are decreased. While *IS-Corp* is currently in a good position to attract third-party developers due to its market penetration, increasing absorption activities may negatively affect value co-creation in the long run. For example, *IS-Corp* has acquired several companies in the areas of procurement and human resource management in the recent years, whose products have in parts been moved onto the *IS-Corp* platform. Thereby, major areas for value co-creation are restricted, reducing third-party developers opportunities and, as a result, their incentives to further contribute to the platform ecosystem.

Second, we interpret co-selling as a value capture mechanism that positively affects value co-creation. Co-selling does not only increase *IS-Corp's* potential for value capture. At the same time, the overall revenue that is generated through third-party applications increases, leading to more revenue that accrues to the third-party developers. Even if *IS-Corp* claims more of that value than without co-selling activities, there can be a positive net effect for the third-party developer that incentivizes other third-party developers to co-create value. The net effect the third-party developer benefits from is dependent on the conditions imposed by *IS-Corp*. For example, if *IS-Corp* claims an unreasonably high share for selling an application under the *IS-Corp* brand, third-party developers will not engage in co-selling. Customer enablement as further facet of co-selling creates potential for value co-creation that had not been visible before. Again, the conditions for value capture by *IS-Corp* need to be reasonable, then customer enablement will not only increase value capture but also value co-creation.

Third, we suggest that verticalization does not have a clear positive or negative interaction effect with value co-creation. On the one hand, dedicated industry verticals create new areas in which value co-creation can take place. By bringing different stakeholders of an industry vertical together, value co-creation emerges, that would not have happened on the horizontal-only platform. On the other hand, a platform that is dominated by a number of industry verticals represents a fragmented platform that requires specialized applications for different uses cases. For third-party developers, there would be no longer a substantial difference to developing dedicated software solutions for an industry without using the platform. For example, *IS-Corp* provides industry-specific solutions for the manufacturing industry. Value co-creation takes place with partners, for example for applications to manage tooling of machines. This specialization entails limited co-creation opportunities across use cases on the platform. Consequently, *IS-Corp* aims at targeting medium-sized customers with the horizontal part of the platform with applications that are more generic and, in addition, implementing industry verticals for industries with large players. In this combined strategy, verticalization should not have an overall negative effect on value co-creation.

In sum, the mechanisms of value capture can have both positive and negative effects on value co-creation. *IS-Corp* is balancing the implementation of value capture mechanisms and their interaction effects with value capture.

6.5 Discussion and Conclusion

In this section, we provide a summary of the mechanisms of value capture we have identified to enhance our theoretical pre-understanding on value capture. We then discuss the mechanisms derived from our case study with regard to IT platforms in general. Based on this discussion, we show implications on the debates of platform openness and performance of digital business strategies.

6.5.1 Tuning Value Capture in IT Platforms

Based on the explorative case study, we identified absorption, co-selling and verticalization as mechanisms of value capture. Absorption includes measures taken by the platform owner such as acquiring third-party applications, imitating successful third-party applications, or incorporating functionality into the platform core that was previously provided by third parties. Co-selling refers to sales activities in which the complementor is involved including bundling, branding and certification or enabling customers to market applications they have developed for their own use. Verticalization includes measures taken to create industry-specific use cases together with third parties that are then marketed in the respective industry. These mechanisms of value capture can in turn affect value co-creation. While we interpret absorption to negatively affect value co-creation, we suggest that co-selling has a positive impact and verticalization does not have a clear positive or negative effect on value co-creation. Our findings are summarized in Figure 11, enhancing our theoretical pre-understanding of value capture in IT platforms.

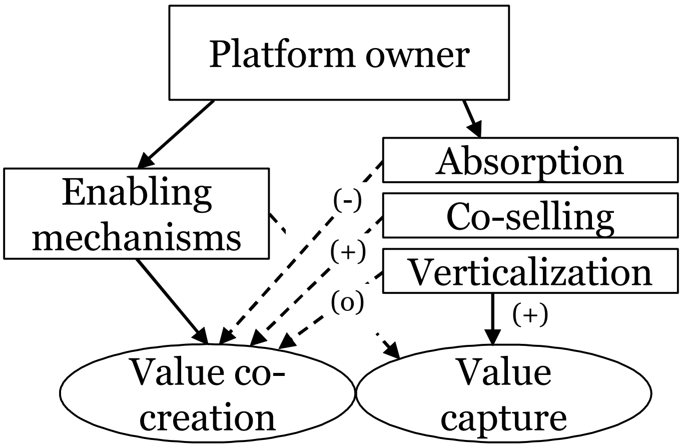

Figure 11. Revised Theoretical Understanding of Value Capture in IT Platforms

The insights on value capture that emerged in our case study contribute to our theoretical understanding of how the platform owner captures value in IT platforms. The mechanism of absorption has already been discussed in literature on B2C IT platforms. Platforms such as Microsoft's Windows have, over time, incorporated functionalities that previously had been provided by third-party developers (e.g., music player or instant messaging) (Eisenmann et al. 2009). With our findings, we not only confirm that absorption is also relevant in a B2B context but we show different manifestations of absorption and discuss the repercussion effect on value co-creation. Our interpretations therefore make a tradeoff explicit that is implicitly visible in previous work (Eisenmann et al. 2011, 2009): absorption has a positive effect on value capture but may have negative consequences for value co-creation. Absorption has to be applied with caution and is contingent on the platform owner's position vis-à-vis the complementors. The more attractive the platform ecosystem is the less harmful absorption activities will be.

The mechanism of co-selling integrates fragmented insights on bundling and new insights on branding, certification, and customer enablement into one concept of value capture. Bundling has been shown to help platform owners with market power to claim more from the available surplus (Eisenmann et al. 2009; Rochet/Tirole 2005). We enhance this view by showing that bundling is in fact a co-selling activity of the platform owner and complementors and thus can have a positive effect on value co-creation in addition to benefits for value capture. Branding and certifications are measures that are rooted in models of B2B partnerships that have existed before IT platforms have become prevalent (Ceccagnoli et al. 2012; Sarker et al. 2012). We show that they are also beneficial in the context of IT platforms, thus established companies may benefit from their experience in these partnership models when implementing an IT platform strategy.

The mechanism of verticalization introduces a new notion of value capture in research on IT platforms. Verticalization does not go as far as vertical integration, where the platform owner would integrate complementary applications and close off the platform (Parker et al. 2017). By applying verticalization, the platform, while remaining horizontal, is enriched with vertical use cases for specific industries. This approach is particularly useful for technologically complex platforms that comprise several layers, such as a device or machine layer, a data layer, a micro-service layer and an application layer. Many B2B IT platforms exhibit such complex architectures, for example in the area of IoT. For those platforms, the mechanisms of value co-creation and capture previously established in research are not fully applicable as the complexity impedes network effects. Verticalization is one way to nevertheless benefit from the economies of scale an IT platform can yield.

In sum, we first illustrate that value capture is a crucial element of any IT platform strategy. This finding contributes to literature on IT platforms as existing work focusses predominantly on value co-creation (e.g., Ghazawneh/Henfridsson 2013; Eaton et al. 2015; Boudreau 2010). Value capture thereby goes beyond the aspects discussed in literature such as pricing (Hagiu 2006; Tiwana 2014) and bargaining (Oh et al. 2015). To capture value, platform owners can leverage a set of diverse mechanisms and our study gives a first impression of what shape these mechanisms can take. Second, we show that understanding the interaction effect of value capture and value co-creation is crucial for the success of IT platforms. We contribute to discussions in management and IS literature on the relation of value creation and value capture (e.g., Lepak et al. 2007; Priem 2007; Bharadwaj et al. 2013) by providing examples how distinct mechanisms of value capture affect value co-creation. Considering these interaction effects helps to avoid enforcing value capture when it is harmful to co-creation or to recognize that the gains in value capture will overcompensate losses in value co-creation.

6.5.2 Value Capture and the Debate of Platform Openness

Results on value capture inform the debate of how open IT platforms should be designed towards complementors (vertical openness) (Boudreau 2010; Thomas et al. 2014; Benlian et al. 2015; Ondrus et al. 2015). The debate revolves around choosing the right degree of openness to balance the tradeoff between diversity and control (Benlian et al. 2015; Boudreau 2010). A high degree of openness supports a high quantity and variety of complementary applications but comes along with reduced possibilities to control the activities and outcomes in the platform ecosystem. Vice versa, strict control is implemented to ensure quality and other standards but, in turn, reduces the platform's openness and thus its generativity.

The mechanisms of value capture that we identified affect the platform's openness or at least the perceived openness from the complementors' viewpoint. For example, absorption activities will make the platform appear more closed as the platform owner restricts the degrees of freedom of the complementors. Even if the platform, on a technical basis, remains open to anyone, absorption can lead to a more restricted platform ecosystem. Capturing value through verticalization will make the group of possible complementors smaller, as more specialized complementors are to address a smaller market compared to a platform without verticalization strategy.

The decrease in perceived openness may lead to performance losses of the platform ecosystem as a whole (Ondrus et al. 2015; Benlian et al. 2015). Therefore, platform owners need to align the mechanisms of value capture they apply with their strategy regarding openness and control. For example, occasional absorption might not be harmful in large and open ecosystems. Google imitated several third-party applications on Android such as an internet browser or maps and navigation. Due to the ecosystems size and openness, this did not affect the value co-creation taking place in the ecosystem.

At the same time, implementing a strategy for openness and control needs to be viewed in front of possible effects on value capture. Boundary resources contribute to a platform's openness as they support complementors in developing applications (Eaton et al. 2015; Ghazawneh/Henfridsson 2013). They directly support value co-creation but the provision and maintenance can be costly – costs that impede value capture. Similarly, control is necessary to a certain degree to ensure the quality of complementary applications (Boudreau 2010; Goldbach/Benlian 2015a). The importance of control is even bigger in B2B IT platforms as the applications can be relevant for critical business processes. However, strict control cannot only impede value co-creation, it is also costly, and thus impacts value capture negatively. In sum, the debate of openness benefits when one keeps in mind that the balance of openness and control is also impacted by the value capture strategy that the platform owner takes on.

In practice, despite the potential of IT platforms being emphasized for years (e.g., Capgemini 2016; Saleh et al. 2016), many firms struggle to set up an IT platform from which they capture a sufficient share of the co-created value (Rietveld et al. 2016; Bharadwaj et al. 2013). One reason might be that when designing openness and control of the platform the focus lies too much on facilitating value co-creation at the expense of value capture. Our findings help practitioners to consider their options for value capture early on and design the IT platform with the corresponding degree of openness. As we observe more and more initiatives to establish B2B IT platforms for example in the Internet of Things, we hope that these platforms in particular benefit from our considerations.

6.5.3 The Performance of Digital Business Strategies

We furthermore contribute to the discussion on the effect of digital business strategies on the performance of firms (Bharadwaj et al. 2013; Rai/Tang 2014). The challenge of value capture is not limited to IT platforms but arises in other digital business strategies, such as digitally integrated supply chains in manufacturing or customer-centric digital provision of services in banking (Setia et al. 2013). The basic challenge remains the same: Value is co-created in interfirm networks with partners and the focal firm needs to capture a sufficient share. While existing research acknowledges that the interplay of both value co-creation and capture determines market performance (Rai/Tang 2014), the source for value co-creation and capture are not well understood (Bharadwaj et al. 2013).

In our study, we focused on the example of IT platforms as digital business strategy but most of the digital business strategies comprise complex interfirm networks (Nalebuff/Brandenburger 1997). Thus, the mechanisms of value capture we identified can be, to a certain degree, applied in other settings. For example, absorbing products or firms that improve the IT integration capabilities within a supply chain is likely to help the focal firm to capture value from the supply chain's co-created value. In a customer-centric interfirm network for digital service provision, co-selling with network partners can be crucial for success. Without co-selling, it will be difficult to enable a seamless customer experience for heterogeneous customer groups across different platforms (Setia et al. 2013).

Our results enrich and substantiate existing general insights on value capture in digital business strategies. For example, Rai/Tang (2014) identify bundling, lock-in and barriers to imitation as mechanisms for value capture in IT-enabled business models. Our focus on value capture within the interfirm network adds to these mechanisms, which are routed in competition among firms. This broadened view on value capture is also relevant for strategic management research and its shift from the resource-based view to the relational view of the firm. As we illustrate, not only the locus of value creation has changed from firms possessing and generating inimitable resources to value co-creation within interfirm networks – also value capture has to be viewed as extracting value from a network of partners in addition to extracting value from a market.

In practice, establishing digital business strategies is an ongoing challenge across industries. While our results will not solve the challenges firms face in the digitization, they make practitioners aware that value capture is as central element of a digital business strategy. The mechanisms of value capture we derived in the context of IT platforms provide starting points how value can be captured in other digital business strategies.

6.5.4 Limitations and Future Research

Our study is subject to limitations. First, we interpret value capture as claiming parts of the value that is co-created within the platform ecosystem. At the same time, value capture can be understood as extracting value from a market, i.e., disputing value from competitors (Tiwana 2015). This perspective leads to strategies such as platform envelopment (Eisenmann et al. 2011) and breaching (Ozer/Anderson 2015). We acknowledge that for a comprehensive understanding of an IT platform's success, both views on value capture need to be considered. Yet, the view on value capture within the platform ecosystem has been underrepresented in extant literature. Second, it is inherent to single case studies that generalizing the results is challenging. For example, we have derived our results from a platform in the B2B context, thus they cannot be taken for granted for large scale B2C platforms. We have taken these considerations into account when discussing the generalizability of the results.

We finally suggest two avenues for future research that have emerged during our work, which we could not address within the scope of this study. First, it would be worthwhile to analyze the application of value capture mechanisms and their interplay with value co-creation mechanisms across different platforms and over time. Within such a multiple case study, promising configurations of value capture mechanisms could be identified, contingent on the platforms' specific background (Fiss 2007; El Sawy et al. 2010). Second, during our study, themes related to the IT capabilities required to implement value capture mechanisms emerged. Analyzing empirically which IT capabilities firms need to possess or to develop in order to benefit from their IT platform would enhance our understanding of value capture in IT platforms and contribute to the ongoing discussion of IT capabilities for digital business strategies (e.g., Rai/Tang 2010).

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7 Governing Nonprofit Platform Ecosystems – An Information Platform for Refugees (P4)[14]

Title	Governing Nonprofit Platform Ecosystems – An Information Platform for Refugees
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Publication	Information Technology for Development (2017, Volume 23, Issue 3, p. 618-643, DOI: 10.1080/02681102.2017.1335280)
Status	Published
Contribution of first author	Problem definition, research design, data collection analysis, interpretation, reporting

Table 22. Fact Sheet Publication P4

Abstract

The number of refugees arriving in Europe increased dramatically in 2015. Following arrival at the host country, refugees need access to information on various topics such as applying for asylum, medical care, educational offerings, jobs, or social activities. As many different parties using different channels provide this information, refugees struggle to access relevant information at the right time. Our goal in addressing this information deficit is to support a digital information platform for refugees by developing a governance strategy for the ecosystem of information providers. Within an action research study based on a nonprofit project, we evaluate the implementation of governance mechanisms derived from platform and community governance literature. Our results show that governance mechanisms are implemented differently for nonprofit platform ecosystems than for commercial platform ecosystems. These results enhance the societal impact of the information platform developed in the project. The study contributes to theory on governance of platform ecosystems and IT-enabled collaboration by evaluating established governance mechanisms in the context of nonprofit platforms.

Keywords: Consultation and collaboration across digital differences; eGovernance for good government (eGovernment and eBusiness); Open sourcing; Online communities; IT platform; platform governance

[14] The article is also provided in the Appendix in its original format.

7.1 Introduction

The world has faced a refugee crisis since 2015. In the first half of 2015, the number of refugees under the UNHCR (United Nations' Refugee Agency) mandate reached 14.4 million and increased further in the second half of the year (UNHCR 2015). The regions of origin of the refugees are conflict-affected countries in the Middle East (e.g., Syrian Arab Republic, Afghanistan) and Africa (e.g., Somalia, Sudan, South Sudan). While the majority of refugees are hosted by neighboring countries, an increasing number has sought asylum in European countries. Approximately 1.26 million refugees applied for asylum in the European Union in 2015, the highest number of asylum seekers since the existence of the EU (Eurostat 2016).

Upon arrival, refugees not only need to be supplied with necessities such as medical care, food, shelter, and adequate clothing for local weather conditions, they also need information on, for example, how to obtain medical care, how to initiate the asylum process, how and where to participate in language courses, or how to engage in activities with local residents (Qayyum et al. 2015). Unfortunately, relevant information for refugees is collected and distributed by a large number of different sources. Various governmental agencies, non-governmental organizations (NGOs), local initiatives, and volunteers provide parts of the relevant information – albeit using an often-uncoordinated effort. To complicate matters, the information varies from municipality to municipality and becomes outdated quickly due to regulatory amendments or other changes. In counseling programs for asylum seekers, agencies and volunteers try to bundle the most important information, typically by gathering brochures and flyers, and enrich this printed information with their personal experience. While this effort is extremely important and helpful, it may not be the optimal method to disseminate relevant information: brochures may get lost, content may become irrelevant with time or no longer applicable when refugees are relocated, and information relayed orally may be forgotten or misunderstood.

IT can help to overcome this information deficit. First, IT facilitates the collaboration of different actors to produce information (Brown et al. 2004; Cheng/Yu 2015). Therefore, IT could help different actors to collaboratively collect and edit relevant information for refugees. Second, IT enables the timely and efficient presentation of context-specific information (McKinney/Yoos 2016) and thus could help to provide refugees with relevant information via a digital channel. As the vast majority of refugees has a smartphone at their disposal (see also the discussion by O'Malley in The Independent, 2015) , information can be communicated via mobile applications as a digital channel. Going beyond that, studies have shown that IT can help to promote social inclusion by allowing refugees to participate in an information society, to communicate effectively despite language barriers, and to better grasp the nuances of the society they have entered (Caidi et al. 2010; Andrade/Doolin 2016; Schreieck et al. 2016a).

Given the challenge that information intended for refugees is heterogeneously distributed among different sources and varies from municipality to municipality, an IT-enabled collaboration platform could help to integrate both general and location-specific information for different municipalities. On an IT-enabled collaboration platform, the information provider acts as a complementor by contributing information to the platform, and the refugee acts as a user by consuming this information (Ghazawneh/Henfridsson 2013). The platform itself acts as intermediary, bringing both sides together (Majchrzak, Markus, Wareham, 2016).

Applying platform governance helps to incentivize complementors to participate in platforms and to manage their contributions. As shown for different commercial platforms, platform governance mechanisms cover, for example, the degree of openness of a platform, control mechanisms like quality checks, or boundary resources such as standardized application programming interfaces (APIs) to enable developers to access the platform (Tiwana 2014). Combining these and further governance mechanisms stimulates third party contributions (Manner et al. 2013b).

Existing insights on the governance of commercial digital platforms may not be applicable to nonprofit platforms. In commercial platform ecosystems, the platform owner implements governance mechanisms to manage co-creation of value to capture as much of the generated value as possible (Gawer/Cusumano 2008). In nonprofit platform ecosystems, governance is applied to increase the societal impact of the co-created value and the platform as a whole. Therefore, the underlying strategic goal is not to incentivize the information provider monetarily but to engage them morally in a societal context. Given this situation, the application of platform governance has not, to the best of our knowledge, been discussed. Addressing this gap, we pose the research question: *"How can governance mechanisms be applied to stimulate third-party contribution in nonprofit platform ecosystems?"*

To answer this question, we analyze the application of governance mechanisms on an information platform for refugees within an action research study. We conducted the study within a nonprofit project dedicated to the implementation of an information platform for refugees. At the time of the study (October 2015 – March 2016), the platform had already been used in several municipalities of a European country. Based on governance mechanisms derived from platform governance and community governance literature, the researchers configured governance strategies that were evaluated during two cycles of the action research study. As a result, a sustainable governance strategy was developed that supported onboarding of information providers and ensured their motivation to keep the information updated. Our results provide guidance on how to set up a nonprofit platform governance. In addition, the discussion of the results contributes to IS research in the field of platform governance as part of the literature on co-creation of value for societal impact.

Our study contributes to recent literature in a threefold manner. First, we discuss the application of platform governance mechanisms within a nonprofit context, contributing to literature on IT platforms. Second, we enrich knowledge on IT-enabled collaboration within communities given the fact that the community consists of distributed voluntary workers. Third, our findings relate to research that analyzes how information and communication technologies support social movement organizations in general (Selander/Jarvenpaa 2016) and in the specific context of refugees (Andrade/Doolin 2016). Our findings are also of interest for practitioners in social movement organizations and for those involved in e-government projects, i.e. projects that provide government services to citizens via digital channels (Balta et al. 2015; Adeleke/AbdulRahman 2011; Kuk/Janssen 2013). The governance strategies we developed might help these practitioners to improve the IT-enabled collaboration in their projects.

In the remainder of the paper, we first present related work from platform and community governance, deriving a set of relevant governance mechanisms. After describing the method of action design research, we picture the project, which serves as a testbed for the development of governance strategies. We then describe the results of the study that yielded a suitable governance strategy. Finally, we discuss the implications of our study.

7.2 Theoretical Background

An information platform for refugees can only unfold its societal impact if heterogeneous information providers collaborate on the platform. The collaboration between information providers is IT-enabled, i.e. supported by an IT platform. Through collaboration on the platform, the information providers co-create value and need to be governed such that the co-creation of value is maximized (Grover/Kohli 2012). To review our current understanding of governance in platform ecosystems and IT-enabled collaboration communities, we review and integrate literature from both areas.

7.2.1 Value Co-Creation through Platform Ecosystems

IS research has acknowledged the role of IT in enabling co-creation of value in the development and commercialization of technologies (Nambisan 2013; Boudreau 2010). In particular, digital platform ecosystems foster innovation, software development, and the provision of services (Schreieck/Wiesche 2017; Schreieck et al. 2017a). In a broad sense, platforms can be defined as “foundational products, services, or technologies upon which additional complementary products, services or technologies can be developed” (Gawer 2009b). If a platform is open to the outside (“external platform” versus “internal platform”), the additional complementary products, services, or technologies are developed by third parties as part of a co-creation of value process. As a result, an ecosystem of complementors is created around the platform. We understand platform ecosystems as “a set of actors functioning as a unit and interacting with a shared market for software and services, together with the relationships among them” (Jansen et al. 2009).

The process of co-creation of value has been analyzed for a plethora of digital ecosystems. A large part of the literature discusses application platforms for handheld computing systems such as Google Android and Apple iOS (e.g., Benlian et al. 2015; Eaton et al. 2015; Liu et al. 2014). Further investigations of co-creation of value for digital ecosystems cover gaming platforms such as PlayStation and Xbox (Lin et al. 2011), e-commerce platforms such as Alibaba (Koh/Fichman 2012), and digital content platforms such as YouTube or Amazon Kindle (Lusch/Nambisan 2015). All these examples show how co-creation of value can enhance the success of a commercial platform.

Co-creation of value through platform ecosystems has not yet been analyzed for social causes. While the role of IT to support nonprofit projects has increasingly received attention in IS research (e.g., Andrade/Doolin 2016; Selander/Jarvenpaa 2016), digital platforms and their potential for social causes are often neglected. By enabling co-creation of value, digital platforms can bundle the knowledge and experience of different actors involved in a nonprofit project. In the case of an information platform for refugees, municipalities, private initiatives, and other providers of information collaborate on the digital platform to collect, condense, and attractively present relevant information for refugees. Not surprisingly, co-creation of value through digital platforms is an important area of research in the context of nonprofit organizations and e-government.

7.2.2 Platform Governance

To establish successful platform ecosystems, not only is the platform's architecture decisive, but also the governance of the ecosystem that surrounds the platform (Tiwana et al. 2010). According to Tiwana (2014), platform governance can be defined as the "partitioning of decision-making authority between platform owners and app developers, control mechanisms, and pricing and pie-sharing structures". While Tiwana's dimensions of platform governance are tailored to software application platforms, other authors identify aspects of platform governance by analyzing diverse types of digital platforms. To structure the aspects of platform governance discussed in literature, we derive a set of governance mechanisms that include the dimensions suggested by Tiwana and mechanisms from other studies including mechanisms we identified in an earlier literature study (Hein et al. 2016; Schreieck et al. 2016b).

The first mechanism relates to the overall governance structure, which can be decentralized or centralized (Nambisan 2013). This refers to the partitioning of decision rights and the ownership status of the platform (Tiwana 2014). The second mechanism refers to accessibility and control of platform ecosystems. A platform ecosystem needs to be open to a certain degree (Eisenmann et al. 2009) but openness needs to be accompanied by control mechanisms to avoid uncoordinated effort hindering co-creation of value (Ghazawneh/Henfridsson 2013; Tiwana 2014). Control mechanisms include formal control as in input and output control and informal control as in self and clan control (Goldbach/Benlian 2015a). Trust forms the third mechanism, which relates to the measures of a platform ecosystem to enhance trust and reduce perceived risk (Nambisan 2013; Hurni/Huber 2014) on the complementor or user side. As the continuous interaction of complementors and users is vital to platform ecosystems, trustful relationships must be built. The fourth mechanism summarizes boundary resources, which represent all kinds of resources a platform provides for complementors (Ghazawneh/Henfridsson 2013; Eaton et al. 2015). These may cover documentation on the platform, tools, or APIs. In most platform ecosystems the mechanism of pricing is relevant as an additional mechanism (Caillaud/Jullien 2003; Tiwana 2014). As the refugee information platform is a voluntary project void of financial transactions on the platform, we will not include this mechanism in our study.

7.2.3 Community Governance and IT-Enabled Collaboration

An information platform for refugees is dependent on a platform ecosystem with heterogeneous information providers that collaborate in communities. While application developers of software platforms can develop complementary applications individually, information providers need to create the information together as part of a temporary information network (Pan et al. 2012). A community is necessary to compile the information for each municipality providing information on the platform. Local communities need to cooperate with other communities to avoid redundant work, which may prove difficult due to the autonomy of different municipalities. Overcoming challenges of this kind has been identified as one of the key objectives of collaboration between governmental agencies in developing countries (Ezz et al. 2009).

The setup of our study is similar to other community projects such as knowledge communities (e.g., Wikipedia) or open source communities (e.g., Linux). IS researchers have in particular worked on open source communities to derive governance mechanisms and strategies for IT-enabled collaboration in online communities (Shah 2006; O'Mahony/Ferraro 2007;

Teixeira/Lin) as well as on the importance of those communities in developing countries (Ahmed 2007; Hatakka 2009).

The governance of online communities faces issues similar to those faced by the governance of platform ecosystems. One example might be trust, which is not only an important governance mechanism in platform ecosystems but also crucial for collaboration in online communities (Cheng et al. 2013) and distributed teams (Cheng et al. 2016b; Cheng et al. 2016a). Furthermore, in both communities and platform ecosystems, third parties contribute to a joint project and need to be incentivized and managed throughout the period of participation. According to Sagers (2004): “a project must deal with the complexity of coordinating the efforts of a geographically distributed base of volunteers to create a working software product.” Mechanisms to govern communities are discussed by Markus (2007) and De Laat (2007). According to Markus (2007), community governance includes six categories of formal and informal structures and rules: ownership of assets, chartering of the project, community management, software development process, conflict resolution, and use of information and tools. The mechanisms proposed by De Laat (2007) cover modularization, division of roles, delegation of decision-making, training and indoctrination, formalization, and the tradeoff between autocracy and democracy.

These mechanisms are related to the mechanisms of platform governance discussed above. We integrate the mechanisms of community governance and the mechanisms of platform governance in a summary table (Table 23).

Mechanisms	Platform governance	Community governance
Governance structure	▪ Centralized vs. decentralized ▪ Distribution of decision rights ▪ Ownership status	▪ Autocracy/democracy ▪ Chartering rules ▪ Ownership of assets ▪ Division of roles, delegation of decision-making
Accessibility & control	▪ Openness ▪ Control mechanisms	▪ Software development process ▪ Formalization ▪ Modularization
Trust	▪ Trust building ▪ Minimization of perceived risk	▪ Conflict resolution
Boundary resources	▪ Resources and documentation ▪ Transparency	▪ Training and indoctrination ▪ Use of information and tools ▪ Community management

Table 23. Mechanisms of Platform and Community Governance

The summary of governance mechanisms across platform governance and community governance identifies which aspects of governance are relevant for a project such as an information platform for refugees. However, it remains unclear how these mechanisms can be implemented in the context of nonprofit platform ecosystems. Existing recommendations, as for example those proposed by Tiwana (2014) or Gawer/Cusumano (2014), are based on commercial platform ecosystems such as application platforms and industry platforms.

Nonprofit platform ecosystems differ from commercial platforms in several ways. While in commercial platforms the platform owner can compensate complementors for centralized governance via pricing mechanisms, this mechanism is not available in nonprofit platform ecosystems. Owners of nonprofit platforms are also unable to implement or coerce control. As a result, the platform owner may need other measures to maximize value creation within the platform ecosystem. The mechanism of trust might gain importance in nonprofit platform ecosystems as complementors invest their effort voluntarily without expectations of direct benefit. While trust is also relevant for complementors in commercial platforms (Hurni/Huber 2014), it is a decisive factor for nonprofit organizations in general (Bekkers 2003). Because nonprofit platforms depend on contributions from third parties to carry out their daily work, trust is not only important for their reputation but is also a prerequisite for third parties with potential interest in contributing to the platform.

In summary, existing research helps to identify governance mechanisms relevant for nonprofit platform ecosystems. Yet, our current knowledge is not sufficient to understand how governance mechanisms can be applied in order to successfully bring together and manage the IT-enabled collaboration of various actors on a nonprofit platform. In particular, incentivizing the actors to contribute to the platform while at the same time controlling them is an open issue for nonprofit platforms. We address this gap with an action research study focusing on governing information providers within an information platform ecosystem.

7.3 Method

We conducted an action research study to develop a strategy for the governance of an information platform ecosystem for refugees. Action research has been defined as "a post-positivist social scientific research method, ideally suited to the study of technology in its human context" (Baskerville/Wood-Harper 1996). We chose this methodology for two reasons. First, action research is applicable to evaluate a complex and rare phenomenon not suitable for empirical analysis (Mathiassen 2002). The ecosystem of an information platform is complex due to a large number of heterogeneous information providers. As a result, the development of a suitable governance strategy is also a complex and challenging process. Governance strategies for these types of information platforms are rare: the first digital information solutions for refugees emerged in 2015 and only a few of them have been established successfully. Second, action research is adequate if it is necessary to not only gain insights on a phenomenon but also to directly apply the knowledge in practice to advance the project (Mathiassen 2002). Due to the criticality of the situation of refugees arriving in Europe, it made sense to directly apply the developed governance strategy in order to help refugees as soon as possible.

Action research studies are a special form of case studies. In contrast to traditional case studies where researchers observe the object of the study, in action research studies the researchers actively participate in the project to both take and evaluate actions (Yin 2014). This participatory design was possible as the authors were part of the project team. As part of the project team, we implemented platform governance mechanisms to stimulate third-party contribution to the platform. The effect of these interventions was evaluated based on usage data and additional insights from workshops and interviews with information providers.

We followed the cyclical process of action research along five steps (Ziegler 2001; Susman et al. 2012): (1) *Diagnosing* to identify or define the problem at hand; (2) *Action Planning* to consider alternative actions that can be taken to solve the problem at hand; (3) *Action Taking* to select suitable actions and implement those actions; (4) *Evaluating* to assess the consequences of the actions taken; (5) *Specifying Learning* to gain general insights from the approach taken to tackle the project at hand. We ran through this process twice to develop a governance strategy for the information platform for refugees. To ensure rigor and relevance of our action research study, we evaluated the study against the five evaluation principles for action research studies as laid out by Davison et al. (2004). As summarized in Table 60 in Appendix D, our study fulfills the *Principle of the Researcher–Client Agreement*, the *Principle of the Cyclical Process Model*, the *Principle of Theory*, the *Principle of Change through Action*, and the *Principle of Learning through Reflection* (Davison et al. 2004).

7.4 The Case of INTEGREAT[15]

Before evaluating governance strategies, this section pictures the case that frames the action research study. We first provide an overview of the project *INTEGREAT* and then describe the main governance challenges faced by the project.

7.4.1 Project Description

The point of departure of the project *INTEGREAT* was the arrival of a large number of refugees in Europe in summer 2015 who then encountered a lack of information about their new environment (see also Qayyum et al. 2015). This information deficit is a direct result of the complex information ecosystem faced by refugees. As illustrated in Figure 12, refugees are dependent on information related to various topics that can be roughly clustered as follows: information on first steps related to registration and government requirements, points of contact, language, health care, education and work, family and daily life. A large number of different information sources addressing these information needs are available. In addition to the high heterogeneity in the information sources, the information is dynamic and, in some cases, quickly outdated. Local points of contact may change, new offers may be introduced, and adjustments made to the asylum process. Refugees are often relocated after arrival at an initial reception facility making parts of the information inaccurate for later use (Schreieck et al. 2017d).

[15] www.integreat-app.de

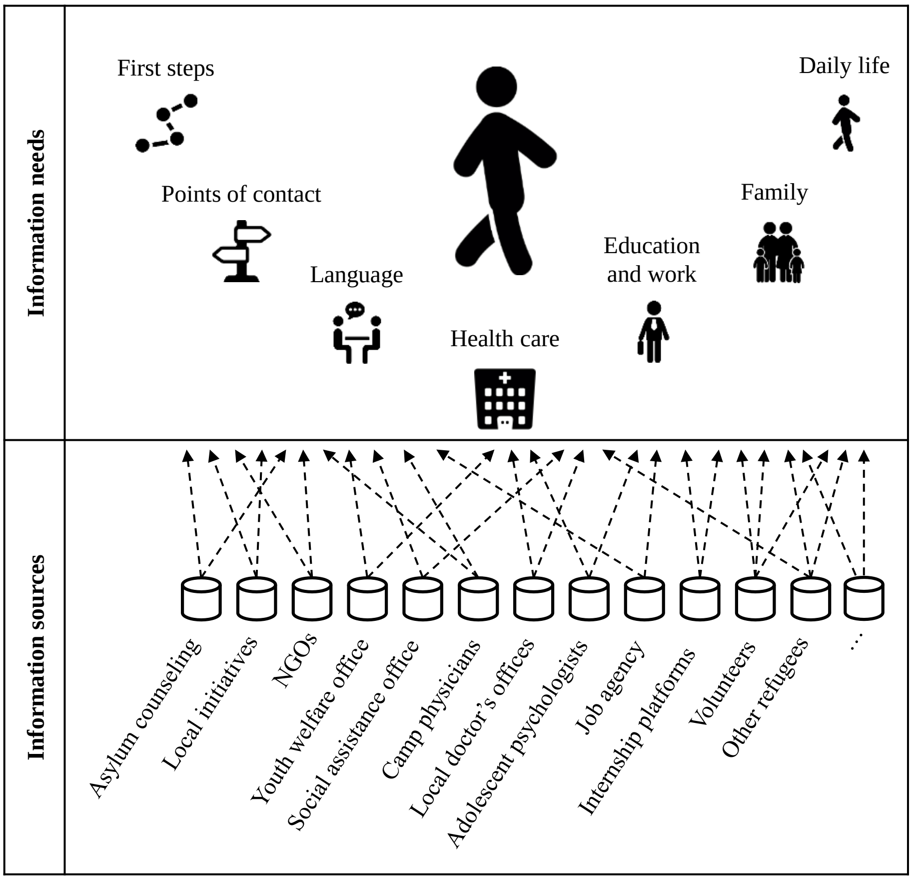

Figure 12. Heterogeneous information ecosystem for refugees.

The project *INTEGREAT* strives to address the information deficits of refugees. *INTEGREAT* is a mobile application that provides relevant information for refugees via a smartphone application. The app comprises general information as well as specific information of relevance in the respective municipality. Users choose the municipality according to their location when they open the app. The information provided in the app is also available offline. Refugees usually have only sporadic access to the internet as they use local Wi-Fi hotspots and generally do not have mobile service. The app is available in different languages: In addition to English, French and German, the languages of the major countries of origin are included, in particular Arabic and Farsi. The mobile app was developed in Android as our experience during the project was that the majority of refugees uses smartphones with this operating system. Exemplary screenshots of the INTEGREAT mobile app are shown in Figure 13.

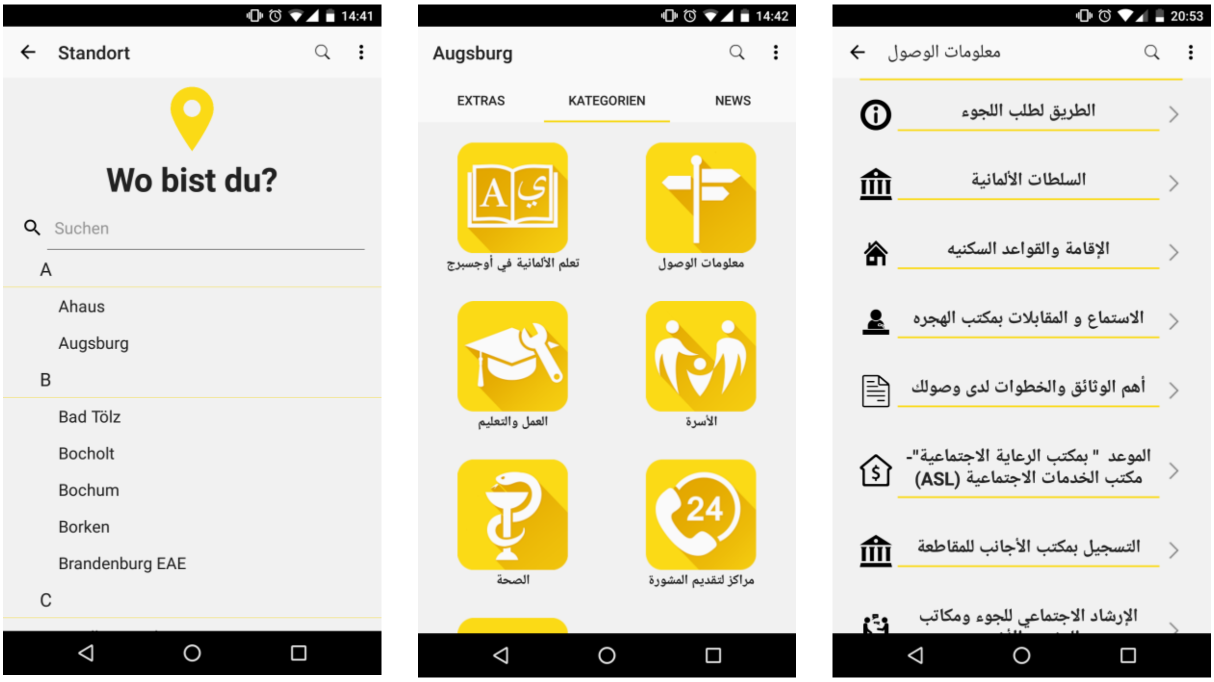

Figure 13. Exemplary Screenshots of the INTEGREAT Mobile App (from left to right: location selection, main categories, and subcategories; source: Tür an Tür Digital Factory gGmbH, 2017)

The counterpart of the mobile app is the backend, which is used to input the information displayed in the app. The backend comprises a content management system (CMS) based on WordPress. WordPress is a free open source software to build blogs, websites and CMS (WordPress 2016) and was chosen as it is the most successful available free tool for websites and is therefore very likely to be further developed and maintained in the future. The basic configuration of WordPress was enhanced by available plugins to support, for example, multi-language sites. Some plugins were developed by the project team to address specific needs of the users such as a multi-language PDF export of information in case refugees do not have a smartphone.

A municipality wanting to use the system is granted access to a dedicated instance of the CMS backend realized via a multi-site setup of the WordPress-powered CMS. The instance is pre-filled with general information common for all municipalities including information on the asylum evaluation process. Users from the municipality can then decide to edit the available general information and start to add information specific to their municipality. As the information for one municipality is distributed among a large number of information providers, an arbitrary number of users can be granted access to the system. The user management comes with a fine-grained rights management. For example, a local initiative that organizes regular events for refugees can be granted access only to the Events section of the CMS. In this way, a local community of information providers emerges. In summary, the project *INTEGREAT* provides a stable core architecture that forms the basis of the information platform as pictured in Figure 14.

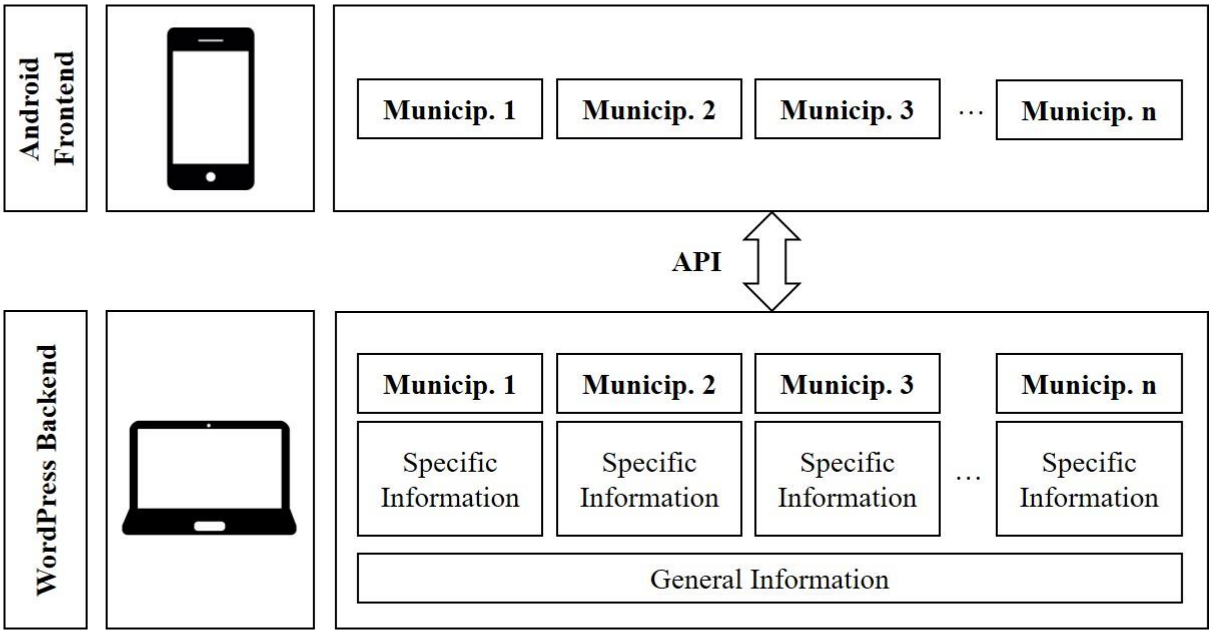

Figure 14. System Architecture

The setup of the project as a platform allows different information providers and stakeholders to interact with the project team and the system. These groups need to be considered when developing a governance strategy. Besides the core team and developers, municipalities, non-governmental organizations (NGOs), local initiatives, and volunteers are the main information providers (Figure 12). The municipalities run several offices such as the social assistance office or the youth welfare office who possess valuable information. NGOs and local initiatives have gained domain-specific knowledge through their continual work with refugees and volunteers and are able to add specific information such as event information. Sometimes the information providers pursue different goals and are driven by a different political agenda making the governance of the ecosystem more challenging.

7.4.2 Governance Challenges

Managing the ecosystem of information providers and stakeholders emerged as the main challenge for the project *INTEGREAT*. Although some technical challenges arose in the course of the project, for example, related to the interplay of plugins in WordPress, these challenges never represented a serious risk for the project. Instead, the main issues were related to the acquisition of information providers, the identification of relevant contact persons in the municipalities, and the handling of information overflow often produced by the providers of information. As the platform ecosystem grew, further issues arose. The motivation of information providers had to be ensured and a decentralized method to organize information providers that at the same time ensured content quality had to be established.

The description of the main challenges makes clear the necessity of a governance strategy to manage the heterogeneous community of information providers. The governance mechanisms derived from literature, i.e. governance structure, accessibility and control, boundary resources, and trust can help to address these challenges. However, literature does not provide insights on how to apply these mechanisms in the context of *INTEGREAT*. Accordingly, the project team was unsure how centralized the governance should be structured in order to keep the project manageable while incentivizing decentral information providers. The team had to decide whether to apply formal control mechanisms to ensure content quality or whether to rely on informal mechanisms. In addition, we were unsure how to build trust between the different parties and which boundary resources should be provided for information providers. Therefore, it was crucial for the project's success to evaluate how the governance mechanisms as part of a sustainable governance strategy should be best implemented.

7.5 Governance Strategy

A governance strategy is the result of the planned implementation of governance mechanisms in a specific configuration (see also Schwarz/Hirschheim 2003). We derived the following governance mechanisms from platform and community governance literature: governance structure, accessibility and control, trust, and boundary resources. Within an action research study with two cycles, we define, evaluate, and refine the implementation of these mechanisms as part of a governance strategy. The effectiveness of the strategy was measured using the number of new municipalities that implemented *INTEGREAT* and the activity level[16] on the content management system of the platform. We enhanced the quantitative analysis with qualitative insights from workshops, interviews, and surveys conducted with information providers and refugees as summarized in Table 24. Throughout the Results section, we will refer to these insights. We analyze the two action research cycles following the phases of an action research study as described by Susman et al. (2012): Diagnosing, Action Planning, Action Taking, Evaluating, and Specifying Learning.

ID	Type	Participants	Date
W_1	Workshop	▪ Three employees of the social office of a German municipality considering introducing *INTEGREAT* ▪ Three members of the *INTEGREAT* project team	October 21, 2015
I_1	Interview	▪ Chairperson of a nonprofit association. She led the introduction of *INTEGREAT* in a German municipality. ▪ One member of the *INTEGREAT* project team	January 11, 2016
S_1	Survey	▪ Survey among 15 refugees in Germany who tested the *INTEGREAT* mobile app	February 2016
W_2	Workshop	▪ Regional coordinator for refugee initiatives ▪ Member of nonprofit organization that supports disadvantaged people throughout Germany ▪ Two members of the *INTEGREAT* project team	February 12, 2016
W_3	Workshop	▪ Several members of the government of a German municipality ▪ Several refugees hosted by the municipality ▪ Two members of the *INTEGREAT* project team	September 22, 2016
S_2	Survey	▪ Feedback survey among information providers with 39 participants	December 2016

Table 24. Sources of Qualitative Insights

7.5.1 First Action Research Cycle

The first action research cycle to develop a governance strategy of the *INTEGREAT* platform started when the basic functionalities were implemented for the first municipality in October 2015. The positive feedback the project received in the media and from other municipalities made it clear that *INTEGREAT* could be beneficial for all municipalities hosting a substantial

[16] Activity was measured as the number of 'save' and 'edit' operations performed in the CMS.

number of refugees. Therefore, the research team together with the project team decided to roll out the information platform, requiring a governance strategy to incentivize and manage information providers.

Diagnosing and Action Planning. In the first two months after the start of *INTEGREAT* in the first community, more than 20 municipalities and associated information providers were interested in the platform and requested information on how it could be introduced in their municipality. It was not sufficient to just grant the municipality access to their own instance of the CMS. New municipalities needed to be supported to onboard successfully and in a sustainable way. Literature shows that the initial phase of a platform ecosystem is decisive for its success (e.g., Evans/Schmalensee 2010). Therefore, the project team together with the researchers developed actions suited to govern the heterogeneous information providers.

Action Taking. Actions were taken across all governance mechanisms to support the integration of new municipalities in the ecosystem (Table 25). The governance structure had to be decentralized in order to incentivize volunteers and to cope with the decentralized information structure. Therefore, new municipalities were given direct access to the system and the possibility to enter and structure information in their preferred way. Similarly, restrictions were minimized for the mechanism accessibility and control. Barriers for new members were reduced by making the CMS as intuitive as possible and no dedicated control process was introduced to prevent the demotivation of information providers. To strengthen trust in the project and its sustainability, the project collaborated with an established initiative that has been engaged in work with refugees for more than two decades and with a renowned university. Boundary resources were distributed by the team members on an individual basis through, for example, individual counseling of information providers wanting to use the platform.

Mechanisms	Description	Actions taken
Governance structure	Decentralized governance in order to incentivize volunteers and to handle decentralized information structure.	▪ Direct access for content providers to the content management system (CMS) ▪ Decisions on information and information structure made by information providers
Accessibility & control	Open platform with free access for information providers.	▪ Intuitive CMS ▪ No dedicated quality control of information
Trust	Build trust in sustainability of the project.	▪ Partnering with established initiative ▪ Official support of the project by universities
Boundary resources	Resources distributed by team members on an individual basis.	▪ Individual counseling for information providers

Table 25. Governance Strategy "Onboarding" in the First Action Research Cycle

Evaluating and Specifying Learning. The evaluation of the number of new municipalities that implemented the information platform showed that the governance strategy was efficient regarding the onboarding of complementors on the platform. In the first month, six municipalities requested to roll out the system in their area and initiated the collection of information followed by a roll out by nine municipalities in the second month (Figure 15). Based on feedback from the contact persons, we identified the governance actions that had the largest impact on the onboarding decision. It was important that the CMS was intuitive to use as information providers from municipalities, NGOs, and local initiatives were not as IT-savvy as initially expected (I_1, Table 24).

Collaboration with an established initiative in the area of asylum counseling had proven helpful in enhancing the complementors' trust in the platform ecosystem (W_1, Table 24). However, the analysis of activity data on the CMS showed that after the first two months, the activity level of information providers declined (Figure 16). Some municipalities lost interest shortly after onboarding and others gathered most of the relevant information but did not manage to finalize it. Furthermore, a quality check of the information on the platform revealed an overflow of unstructured information in some topics, while others were not covered (S_1, Table 24). As this unstructured information was, for some municipalities, visible in the app, this posed a threat to the project's reputation.

Given the learning of the first action research cycle, the onboarding-focused governance strategy was in part successful in the early phase of the project but needed refinement to improve the sustainability of the involvement of the information providers.

7.5.2 Second Action Research Cycle

The governance strategy in the first action research cycle had resulted in onboarding of a significant number of municipalities. Local media coverage, dedicated articles in journals for mayors of municipalities and other members of bodies of the government as well as information distributed via social media sparked interest in the project. However, onboarding had not been sustainable for all municipalities. Therefore, the governance strategy was adapted with a stronger focus on sustainability. The goal was to enable continued onboarding while at the same time ensuring that the municipalities would not lose interest.

Diagnosing and Action Planning. Although the pilot municipality successfully introduced the platform, not all of the municipalities that started using the platform finished the introduction process of the *INTEGREAT* app. Those who finished the implementation had included a lot of unstructured information potentially leading to an information overflow for the user. The main challenge of the second action research cycle was therefore to identify governance actions that increase the information providers' motivation and at the same time improve the quality of the provided content. The underlying tradeoff between the openness of platform ecosystems and control of complementors is a known issue in research on commercial platform ecosystems (e.g., Benlian et al. 2015; Boudreau 2010).

Action Taking. Actions were taken across all governance mechanisms to refine the governance strategy (Table 26). For the governance structure, elements of a more centralized governance were introduced in order to improve the quality of content on the information platform. It was decided to introduce a standardized structure for the content that had to be implemented by municipalities. The so-called 6+2 concept comprises six predefined chapters of information and two chapters to be defined by the individual municipality. This structure should not only make the information more easily searchable, but also increase the "brand recognition" of the *INTEGREAT* app. To balance the more centralized governance structure, the possibility to market the app as a stand-alone information app by a certain municipality was introduced. While the app would adhere to the "corporate identity" of *INTEGREAT*, the commitment of the municipality would become more visible increasing the motivation of the people involved. A more structured onboarding process and a pragmatic input control were introduced for the governance mechanism accessibility and control. A structured onboarding process helped municipalities to better understand the scope of the project and estimate the resources they needed to invest in the project. The input control was assigned to one responsible person per municipality. In this way, input control was decentralized yet formalized. While decentralized control might be less effective than centralized control, it addressed the problem of missing perceived legitimation of the platform owner to implement control. Trust had emerged as an important factor in the first research cycle. Consequently, the founding of a nonprofit association[17] was emphasized; it was thought that the establishment of a legal entity behind the project would serve to strengthen the information providers' trust in the project. Furthermore, open sourcing of the *INTEGREAT* project's source code along with the content of the platform contributed to the project's credibility. Intangible boundary resources were implemented in the second research cycle to support municipalities in compiling relevant information on the platform in a structured way. First, a dedicated community manager who consults the responsible contact person on how to manage the local community of information providers was introduced. Second, to improve the exchange of information and best practices among municipalities, conferences were organized and a common communication tool was introduced. Both measures are known to improve the meta-knowledge of the involved information providers, i.e. the knowledge of 'who knows what' and 'who knows whom' (Leonardi 2014). As tangible boundary resource, translation support was provided by making automated translation accessible in the CMS and by cooperating with a professional translation agency.

Mechanisms	Description	Actions taken
Governance structure	Elements of a more centralized governance.	▪ "Corporate identity" but possibility of local stand-alone app ▪ 6+2 structure of content with general content prefilled
Accessibility & control	Introduction of pragmatic input control.	▪ Structured onboarding process for content providers ▪ Quality check for information
Trust	Strengthen trust in sustainability of the project.	▪ Foundation of a nonprofit association ▪ Open sourcing of code and content
Boundary resources	Focus of intangible but effective boundary resources.	▪ Dedicated community manager ▪ Conferences for content providers ▪ Slack as tool for communication in a decentralized project setting ▪ Translation support

Table 26. Governance Strategy "Sustainable Onboarding" in the Second Action Research Cycle

Evaluating and Specifying Learning. After the implementation of the new "sustainable" governance strategy, the activity on the platform increased significantly while at the same time new municipalities continued to onboard (see Figure 15 and Figure 16). The values for activity in December 2015 and January 2016 were affected by the Christmas holidays but February and March 2016 showed a substantial increase in activity. The information provided on the platform became more complete and structured for the new municipalities compared to the first action research cycle. Municipalities reported that the hierarchical 6+2 concept in the CMS helped them to structure the information better (S_2, Table 24). The founding of an NGO convinced municipalities and information providers that the *INTEGREAT* project would be sustainable and therefore they were motivated to contribute on a long-term basis (e.g., W_3, Table 24).

[17] Tür an Tür Digital Factory gGmbH, http://tuerantuer.de/digitalfabrik/.

Information providers welcomed the boundary resource of automated translation (S_2, Table 24).

In sum, the "sustainable onboarding" governance strategy was a successful enhancement of the "onboarding" governance strategy applied in the first action research cycle. Based on discussions with contact persons in the municipalities, the balance of more guidance and stronger trust in the societal impact of the project were key to an effective governance strategy.

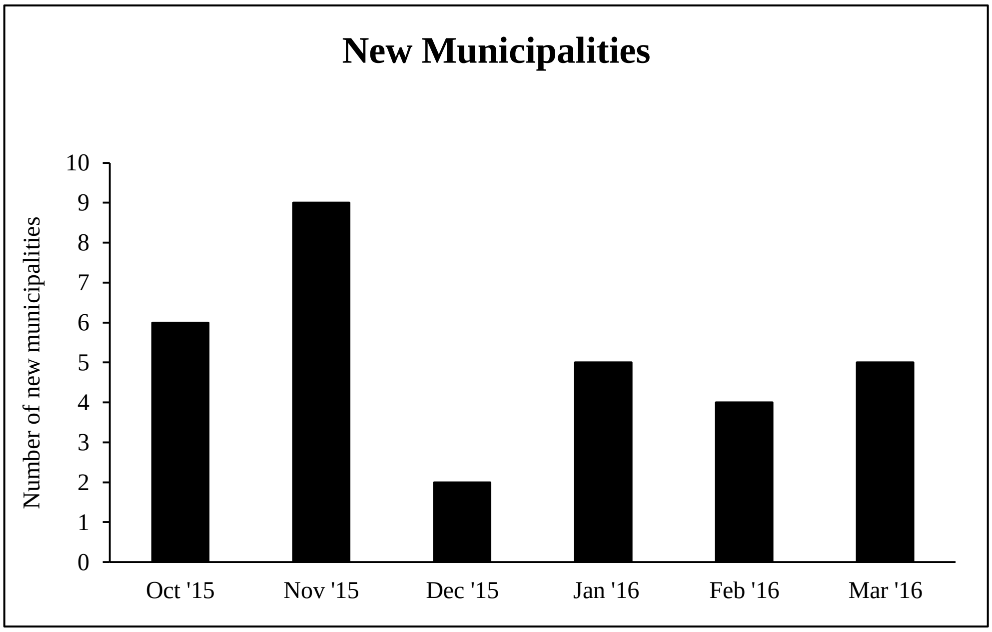

Figure 15. Acquisition of Municipalities

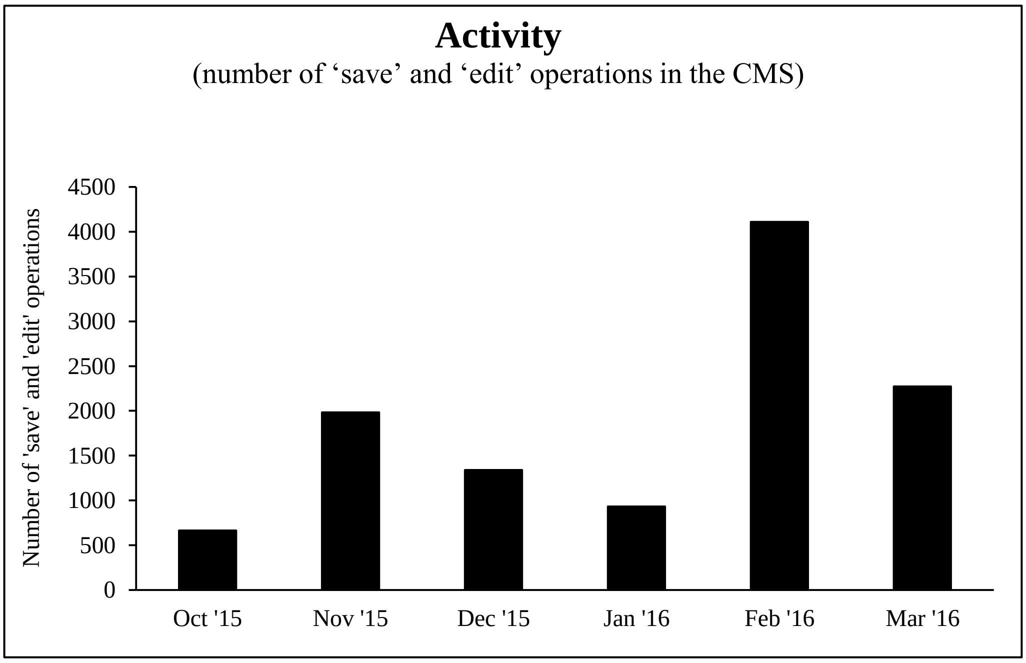

Figure 16. Activity on the Platform

7.6 Discussion

In this section, we discuss how our findings inform the application of governance in nonprofit platform ecosystems as compared to commercial platform ecosystems. We then discuss the contributions our work makes to theory and practice in the area of governance.

7.6.1 Governance in Nonprofit vs. Commercial Contexts

The governance strategy we developed in our study differs from strategies known from commercial platforms along the mechanisms governance structure, accessibility and control, trust, and boundary resources. The implementation of each governance mechanism is affected by the fact that the platform is non-commercial and serves a social cause (Table 27).

Mechanisms	Commercial platform ecosystems	Nonprofit platform ecosystems
Governance structure	▪ Balance centralization against shared pricing	▪ Balance centralization against chartering and representation
Accessibility & control	▪ Centralized, formal control ▪ Legitimation by ownership and market power	▪ Decentralized, informal control (i.e., clan control) ▪ Legitimation by expertise
Trust	▪ Trust in platform technology and owner ▪ Focus on reliability and continuance	▪ Trust in platform technology and owner ▪ Trust in complementor community ▪ Focus on shared norms and values
Boundary resources	▪ Standardized boundary resources ▪ Focus on documentation and tools	▪ Individual boundary resources ▪ Focus on community management

Table 27. Platform Governance in Commercial and Nonprofit Platform Ecosystems

As decentralized governance had led to an unstructured accumulation of information on the platform, we adopted a more centralized governance strategy. This may in turn have negatively affected the complementors' motivation as they lose decision rights. In commercial platform ecosystems, the platform owner can compensate complementors for centralized governance by providing resources and sharing revenues. In some cases, centralization can be enforced due to the dominant market position of the platform owner (see Eaton 2012 for the case of Apple). By contrast, in nonprofit platform ecosystems, revenue sharing is not available as a compensation for complementors and a dominant market position of an NGO does not necessarily help to enforce governance mechanisms. Instead, centralizing governance in nonprofit platform ecosystems can be built on establishing a relationship which fosters co-creation and openness (Loudon/Rivett 2014). In the *INTEGREAT* project, participating municipalities were supported in hosting a press event and had the opportunity to be an associated partner of the project.

By implementing the governance mechanisms accessibility and control, we found that in an information platform for refugees, input control is necessary to ensure the quality of information. In commercial platform ecosystems, formal and informal control mechanisms are applied by the platform owner in a centralized manner to ensure quality. The platform owner is legitimized by ownership and by his market power. In nonprofit platform ecosystems, applying control can negatively influence the complementors' motivation: from their point of view, the platform owner has no legitimation to apply control. Contributors to nonprofit projects often have a specific idea of how they want to contribute and may be unwilling to adhere to control processes. Therefore, informal control mechanisms such as self and clan control may be more effective than formal control mechanisms. Clan control can be strengthened by establishing a community with shared norms and values (Goldbach/Benlian 2015b). In the project *INTEGREAT*, control processes were assigned to experienced information providers within the local communities of information providers. Due to their expertise, they were perceived by the other information providers as legitimated to apply control.

The mechanism trust may have greater importance in nonprofit platform ecosystems than in commercial platform ecosystems. In commercial platforms, the interplay of trust and power affects the relationship between platform owner and complementors (Hurni/Huber 2014). The complementor has to trust in the reliability of the platform and in the platform owner's intention to continue the platform (Goldbach/Benlian 2015a). In nonprofit platform ecosystems, this trust in the platform is enhanced by trust in the community of complementors (Cheng et al. 2013) and their shared norms and values (Tiwana 2014). Therefore, establishing trust between platform owner and complementors as well as among complementors is vital to nonprofit platform ecosystems. Only when complementors have trust in the platform and the community, their initial motivation will translate into engagement on the platform.

Finally, boundary resources have to be implemented differently in nonprofit than in commercial platform ecosystems. In commercial platform ecosystems, standardized boundary resources such as documentation, tutorials, APIs and SDKs facilitate the onboarding of a large number of complementors. While documentation and easy-to-use interfaces are also helpful in community-driven nonprofit platform ecosystems, the implementation of boundary resources needs to support the community building. Labeled as "indoctrination" by De Laat (2007), measures such as nominating local community managers or holding conferences to connect information providers are boundary resources that enhance the community. Tools that make communication visible (e.g., Slack) further strengthen value creation by the community by increasing meta knowledge of community members (Leonardi 2014). Boundary resources need to be better adapted to the individual complementor and his community.

In summary, governance strategies for nonprofit platform ecosystems differ from those for commercial platform ecosystems in IS. While the same governance mechanisms are applied, they cannot be implemented as effectively in nonprofit as in commercial platform ecosystems due to a perceived weaker position of the platform owner. By making concessions to the complementors in the implementation of a governance strategy, the platform owner can still use platform governance to maximize value co-creation and, as a result, the societal effect of the platform ecosystem.

7.6.2 Contribution to Theory

With our study we contribute to three streams of research: (1) platform governance, (2) IT-enabled collaboration, and (3) IT for development with a focus on refugees.

Scant literature exists on platform governance to manage co-creation of value in nonprofit contexts. The goal of the platform owner is not to capture as much value as possible, but rather to maximize societal impact via co-creation of value. This affects the implementation of platform governance. In our study we show that the governance of nonprofit platform ecosystems is based on the same underlying mechanisms as for commercial platforms but the implementation of the mechanisms differs. Whereas in for-profit platform ecosystems, platform governance aims at maximizing value co-creation along with value capture of the platform owner, in nonprofit platform ecosystems, platform governance helps to stimulate value co-creation in a way that the co-created value is beneficial for society. Furthermore, as nonprofit platform ecosystems are to a greater degree community-driven, the implementation of platform governance is informed by community governance. The integration of community governance concepts is new to platform governance research as platform governance mainly focuses on the perspective of the platform owner. Finally, our study contributes to the literature stream on how information and communication technologies can support nonprofit projects (e.g., Selander/Jarvenpaa 2016) and in particular the integration of refugees (Andrade/Doolin 2016).

By developing governance strategies for communities of information providers that work together via a digital platform we also contribute to literature on IT-enabled collaboration. Online communities are one way IT enables collaboration among diverse parties as evidenced by knowledge communities (e.g., Wikipedia) or open source communities (e.g., Linux). There are both online communities with a dedicated commercial purpose, such as idea platforms created by companies (Blohm et al. 2011), and nonprofit online communities, such as Wikipedia and most open source projects (Teixeira/Lin 2014). While companies that run commercial communities can grant monetary incentives to govern collaboration within the community, governance in nonprofit communities is more difficult. Although O'Mahony/Ferraro (2007) and Shah (2006) analyze this situation for open source projects, we are able to add to their findings for the context of a nonprofit information platform. In particular, we show that the design of the IT artefact that enables collaboration is an important factor influencing collaboration. In the case of *INTEGREAT*, the design and usability of the CMS laid the basis for the implementation of community governance mechanisms. Building on the IT artefact, governance mechanisms such as fostering trust can be applied and spark collaboration on the platform (Cheng et al. 2016b).

Developing and governing a digital platform that supports both information gathering and information seeking is a first step toward understanding the role of information systems in a globalized world challenged with poverty, persecution, and migration swapping in the global North (Heeks 2008; Qureshi 2015). Understanding governance mechanisms for nonprofit platforms is a necessary first step to support collaboration between countries, municipalities, volunteers, and refugees to address the information needs of refugees (Andrade/Doolin 2016). These findings may also inform in a more general way the coordination of social movement organizations in both developing and developed countries (Selander/Jarvenpaa 2016).

7.6.3 Contribution to Practice and Society

First, our study directly contributed to the societal impact of the information platform ecosystem for refugees *INTEGREAT*. By developing a suitable governance strategy, not only did the ecosystem of information providers grow, but also the number of apps installed reached more than 3,300. Thereby, the information gathered on the platform reached the target group and helped to overcome the information deficit of refugees arriving in Europe. Overall it can be shown that important information needs for refugees (Caidi et al. 2010) can be satisfied with the nonprofit platform solution. Especially the boundaries of cross-cultural communication, a major limiting factor for information sharing (Bajwa et al. 2014; Caidi et al. 2010), can be addressed by offering multi language support customized to the individual needs of refugees residing in different municipalities. The information platform will not be able to replace face-to-face asylum counseling but it can make counseling more efficient as basic information is already provided on the platform. For example, the possibility to update information directly in the system reduces the effort required to inform individual refugees about relevant changes. The knowledge on platform governance gained from this study will inform the way new features will be developed and maintained by the community. For example, an offline map and a navigation feature is being developed but it will only be useful if the community provides up-to-date point of interests for the users (see also Pflügler et al. 2016).

Second, the contribution of our study is applicable to other platform ecosystems that enable co-creation of value in a nonprofit context. In e-government the potential of co-creation of value is underrated (Adeleke/AbdulRahman 2011; Kuk/Janssen 2013). Citizen involvement platforms are one example of co-creation of value in e-government that may benefit from insights on the application of governance. Our study provides an overview of the governance mechanisms that need to be considered by platform owners and suggests an adequate implementation of these mechanisms as part of a governance strategy.

Lastly, the concepts we developed on governing nonprofit platforms can be applied to support developing countries by establishing collaboration and knowledge sharing. However, when developing and implementing nonprofit platforms in developing countries, factors such as the technological development of the country, age, education and income of the targeted users, and possibly geographic location (e.g., whether it is more rural or urban territory) need to be taken into consideration (Loudon 2016).

7.7 Conclusion

In this study we derive a governance strategy for a nonprofit platform ecosystem. By conducting an action research study within the project *INTEGREAT*, an information platform for refugees, we combine governance mechanisms to a suitable governance strategy. Our results push the project *INTEGREAT* forward and thus help to overcome the information deficit that refugees face when they arrive in a host country.

The study thereby contributes to co-creation of value theory in the context of nonprofit platform ecosystems. While the same basic governance mechanisms are relevant to foster co-creation of value, nonprofit platforms cannot rely heavily on a centralized governance structure, strict control, and standardized boundary resources. Instead, the governance structure needs to be carefully balanced and trust is a key component of the governance strategy. Our findings furthermore enhance literature on IT-enabled collaboration in nonprofit communities as we show how decentralized local communities of information providers can efficiently collaborate via a digital content management system.

Our study entails several limitations. First, the scope of our action research study is limited. We analyze one case only as the phenomenon at hand, i.e. information platform ecosystems for refugees. Although the project includes a productive information community used by several communities, it is a relatively small platform ecosystem compared to commercial platform ecosystems. By conducting two cycles of an action research study, we obtained in-depth insights into the platform which we compare to current literature on platform governance and IT-enabled collaboration. We therefore believe that the findings of our study are generalizable for nonprofit platforms. Nevertheless, follow-up studies with multiple cases and international NGOs could validate our results, perhaps by applying quantitative methods. Second, as a corollary of conducting an action research study, the active participation of researchers in the project impedes their objectivity. We have addressed this limitation by using adopting triangulation techniques such as interviews, workshops, and surveys to increase the objectivity of our results. Still, traditional case studies could help to minimize methodological bias.

Previous research has showed that collaboration systems also work for developing countries like Tanzania and South Africa (De Vreede et al. 2003), so the next step could be testing social platforms in those regions. Another interesting aspect could be the implementation of collaboration aspects like voting features in order to increase the effectiveness and efficiency of the overall platform (Cheng/Yu 2015). Finally, to better understand the impact of IT for refugees, it could be interesting to analyze the benefit of information platforms. In this context, it would be worthwhile to consider the digital divide (Norris 2001; Ahmed 2007) and what measures could be applied to overcome the digital divide for refugees. For example, a series of qualitative interviews with refugees and asylum counselors in municipalities could contribute to deepening our understanding of the value of IT for the social inclusion of refugees.

7.8 Acknowledgements

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8 Shifting to the Cloud – How SAP's Partners Cope with the Change (P5)[18]

Title	Shifting to the Cloud – How SAP's Partners Cope with the Change
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Publication	Hawaii International Conference on System Sciences (HICSS), 2019
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Contribution of first author	Problem definition, research design, data analysis, interpretation, reporting

Table 28. Fact Sheet Publication P5

Abstract

With the advance of cloud technology, enterprise software vendors have introduced software platforms to facilitate third-party contributions to their ecosystems. This shift towards cloud-based software platforms affects ecosystem partners who have to adopt the new technologies, rethink their business model, and change their sales strategies. To understand how partners cope with this change, we conducted an exploratory case study within SAP's partner ecosystem after the introduction of a cloud-based software platform. By conducting 14 interviews within SAP and 10 partner companies, we identify three distinct coping strategies that partners adopt in the face of the shift to the cloud. Partners either (1) embrace, (2) slow down, or (3) repurpose the change. SAP in turn engages in mediation actions to increase the adoption of its platform and to alleviate possible negative impacts of the coping strategies. These mediation actions contribute to a continuous adjustment of SAP platform strategy. These findings contribute to literature on platform ecosystems by (1) highlighting that partners react differently to change in the ecosystem and by (2) shedding light on the interactions between platform owner and partners in the development of a platform strategy.

[18] The article is also provided in the Appendix in its original format.

8.1 Introduction

In the enterprise software industry, collaborating with partners to offer end-to-end solutions to customers is a crucial part of vendors' competitive strategy (Sarker et al. 2012; Grabski et al. 2011; Ceccagnoli et al. 2012). With the advance of cloud technologies, the collaboration between enterprise software vendors and their partners changes. Instead of developing software extensions that are deeply intertwined with the core enterprise software, partners develop software-as-a-service (SaaS) applications that communicate with the core enterprise software through standardized application programming interfaces (APIs) (Schreieck et al. 2017c). Vendors transform their networks of strategic partners into platform ecosystems with a potentially unlimited number of third-party developers that provide complementary applications. As illustrated by Salesforce, a provider of enterprise software with a focus on customer relationship management, the implementation of a cloud-based software platform can spark innovative contributions by numerous third-party developers (Baek et al. 2014) and lead to sustained success. Furthermore, cloud-based ERP solutions promise advantages such as higher speed and availability and smaller up-front investments for customer, making the solutions more attractive for small and medium-sized enterprises (Eden et al. 2014).

However, existing partners of enterprise software vendors face challenges when a cloud-based software platform is introduced and the ecosystem shifts to the cloud. Partners have to migrate their own products and services to the cloud, change the provisioning of their services, and convince their customers to adopt these cloud offerings (Iyer/Henderson 2010). Coping with these changes is crucial for partners to survive the paradigm shift towards cloud technology. At the same time, the enterprise software vendors that act as platform owners need to understand how they can support their existing partners to cope with the change.

IS research is of limited help to understand the partners' challenges and coping strategies. Researchers have acknowledged the importance of partners for enterprise software vendors and have analyzed the relationship between vendors and their partners. Thereby, the focus lies on how platform owners govern the ecosystem of partners (Hurni/Huber 2014; Schreieck et al. 2016b; Manner et al. 2013b). For the partners' perspective, mainly reasons of partners to join a platform ecosystem have been studied (Rickmann et al. 2014; Ceccagnoli et al. 2012; Huang et al. 2009). To enhance this understanding with regard to how existing partners react to ecosystem changes, we pose the research question: *How do partners of enterprise software vendors cope with the shift to a cloud-based software platform and how can the enterprise software vendor mediate these coping strategies?*

To address this question, we analyze the partner ecosystem of SAP after the introduction of a cloud-based software platform. We conducted 14 interviews within the partner ecosystem. We identified three distinct strategies applied by partners to cope with the shift towards a cloud-based software platform: Partners (1) embrace, (2) slow down, or (3) repurpose the change. We show that the platform owner applies mediation activities and thus adapts its platform strategy based on the partners' reactions.

These findings contribute to literature on platform ecosystems in the context of enterprise software by highlighting that third-party developers cope differently with technological changes in the ecosystem and that the platform owners need to address these differences as part of their platform governance. The results can prove helpful for both enterprise software vendors and their partners in practice. We illustrate specific measures how vendors can react to their partners' coping strategies during the introduction of a cloud-based software platform.

8.2 Theoretical Background

In this section, we describe our theoretical pre-understanding of the role of partners in the enterprise software industry and the increasing importance of platform ecosystems in that context.

8.2.1 Partner Ecosystems in the Enterprise Software Industry

Partners are important for the success of enterprise software vendors. Customers of enterprise software expect end-to-end solutions across their business processes, divisions, and countries of operation. To offer these end-to-end solutions, enterprise software vendors collaborate with partners that fill white spaces in their product portfolio with specialized expertise. For example, it is usually easier for vendors to rely on a local partner to implement country-specific tax regulations in an enterprise resource planning (ERP) tool than to implement it on their own. Furthermore, partners can support global sales and support activities or provide additional services such as consulting or customization of the standard enterprise software (Sarker et al. 2012; Grabski et al. 2011). As a result, enterprise software vendors have established ecosystems of partners that enhance their core offering (Ceccagnoli et al. 2012).

Analyzing how partners engage in these partner ecosystems and how they interact with the enterprise software vendor is thus important for understanding success and failure of enterprise software. While IS research has acknowledged the importance of partners for the success of enterprise software (Sarker et al. 2012; Ceccagnoli et al. 2012), studies mostly focus on the partners' decision to join an enterprise software ecosystem. Factors such as a platform's resources, its market access, leadership, and reputation have been identified to positively influence the partners' decision (Kude et al. 2012; Rickmann et al. 2014; Dellermann et al. 2017). Uncertainty regarding market, technology, and the behavior of the involved actors represent factors that may inhibit participation of partners (Dellermann et al. 2017). Focusing on the partners themselves shows that their downstream capabilities and intellectual property rights are indicators for partnership formation (Huang et al. 2009).

Once partners have joined an ecosystem, they have entered into a relationship with the enterprise software vendor. This relationship is coined by an interplay of trust and power that evolves over time (Hurni/Huber 2014). Furthermore, technological, informational, and value-based asymmetries lead to challenges for partners (Altman 2015) which they address with specific response strategies. In sum, IS research has started to focus on the role of partners in the enterprise software industry and their individual strategies to become a successful ecosystem partner.

8.2.2 Platforms in the Enterprise Software Industry

The advance of cloud technologies enables digital interconnection between products and processes within and across industries (Rai/Tang 2014). In the enterprise software industry, this development has led to the emergence of cloud-based software platforms. We define software platforms as "[…] the extensible codebase of a software-based system that provides core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate" (Tiwana et al. 2010, 676). The underlying change from monolithic to modular software architectures facilitates collaboration of the platform owner with third-party developers that create complementary applications within the platform ecosystem (Tiwana et al. 2010). If the complementary applications are provided as software-as-a-service via the internet, we use the term cloud-based software platform (often referred to as 'cloud platform') (Benlian et al. 2010).

Enterprise software systems have been referred to as platforms before as also on-premises software suites are extensible with partners providing numerous extensions to the proprietary core (Ceccagnoli et al. 2012). However, by relying on cloud technologies, more scalable platform ecosystems emerge. Instead of extensions that are closely integrated in the enterprise software's core, a cloud-based software platform provides an integration layer that separates the core from modular complementary applications. Thereby, the core often remains on-premises, only few companies have recently started to move their whole ERP software to the cloud. Communication between complementary applications and the core happens via standardized APIs (Tiwana et al. 2010) (Figure 17).

The resulting platform ecosystem is similar to those that emerged around software platforms in the context of smartphones (e.g., Google's Android (Tilson et al. 2012a)), video games (e.g., Sony Playstation (Venkatraman 2013)), social networks (e.g., Facebook Apps (Claussen et al. 2013)), or smart home (e.g., Telefónica's BlueVia (Kuebel/Hanner 2015)). In all those platforms, third-party developers develop complementary applications that enhance the platforms core offering. The platform owner engages in platform governance to incentivize third-party developers to join the platform ecosystems and to control the activities within the platform ecosystem (Tiwana et al. 2010).

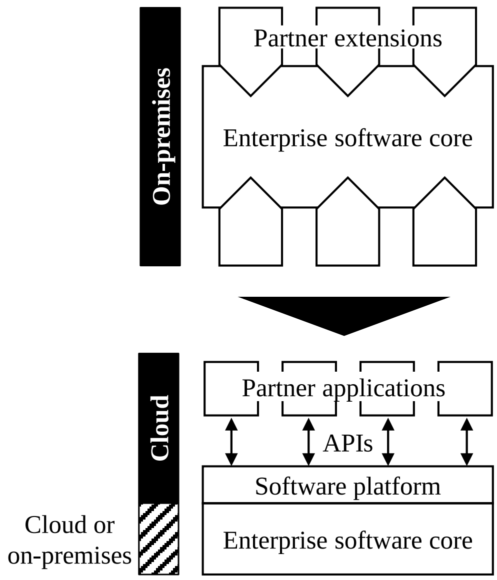

Figure 17. Shift from On-Premises Enterprise Software to Cloud-Based Software Platforms

IS researchers have studied platform ecosystems with a focus on how platform owners set up and manage platform ecosystems. For example, researchers have analyzed the optimal degree of openness of software platforms (Ondrus et al. 2015), the balance of openness and control (Ghazawneh/Henfridsson 2013), or the role of boundary resources to facilitate value co-creation on software platforms (Ghazawneh/Henfridsson 2013; Eaton et al. 2015). Fewer studies take on the perspective of third-party developers. Research focuses on third-party developers' decision to join or desert platform ecosystems (Song 2013; Tiwana 2015). The situation of existing third-party developers who face a technological change in the ecosystem has not yet been analyzed. It thus remains an open question how partners of an enterprise software vendor react to the introduction of a platform and how the platform owner can address the different reactions.

8.3 Method and Case Selection

To explore how partners of an enterprise software vendor react to the introduction of a cloud-based software platform, we empirically study the case of SAP that has established a platform as extension of its ERP system.

8.3.1 Exploratory Case Study

We chose an exploratory case study approach (Yin 2014) for two reasons, following Urquhart et al. (2010). First, the introduction of a cloud-based software platform in the enterprise software industry is a complex and dynamic phenomenon. It is related to interactions between various stakeholders such as the platform owner and its partners. To grasp that complexity, it is helpful to study a specific occurrence of the phenomenon in its context while continuously getting back and forth between data collection and analysis. Second, theories in the context of platform ecosystems are still in an early stage (cf. De Reuver et al. 2018). Thus, it would be difficult to develop a theoretical framework and formulate hypotheses upfront, in particular in view of the heterogeneity of partners in the enterprise software context.

We chose the case of SAP because SAP is a leading provider of enterprise software who has established a cloud-based software platform in recent years. SAP has a large network of existing partners that were affected by the introduction of the platform. Thus, the case is suitable to analyze how partners reacted to the technological shift in the ecosystem.

8.3.2 Data and Analysis

For studying our case, we followed grounded theory methodology procedures for data collection and analysis (Glaser/Strauss 1998; Wiesche et al. 2017). We collected qualitative interview data, selecting our interviewees based on theoretical sampling considerations. We started with interviewees at partner companies that had already adopted the platform. To better understand differences between partners and their strategies, we selected further interviewees at partners that had not yet implemented an offering on the platform but had evaluated doing so.

We conducted semi-structured interviews with decision makers at partner companies and with key employees of SAP in the context of its platform (Gläser/Laudel 2009). In total, we conducted 14 interviews within the ecosystem of the platform between October 2017 and May 2018. The interviews lasted about an hour on average. The interview questions covered the relationship between SAP and its partners, the challenges both sides faced related to the shift to the cloud along with the strategies how they faced these challenges.

In addition to interview data, we gathered rich secondary data. The first author participated in a full day workshop organized by an SAP partner association with more than 100 participants and was able to validate the results in numerous informal conversations and within a workshop session on cloud adoption. We furthermore analyzed partner agreements and videos from developer conferences. We provide details on the data sources we relied on for the exploratory case study in Table 29.

Primary Data: Interviews		
Organization	**Description**	**Interviewee**
SAP	Multinational software company focusing on ERP software	▪ Product owner of SAP's platform ▪ Developer from the platform team
Partner#1	Consultant partner with focus on ecosystem strategy and go-to-market	Founder/CEO
Partner#2	Global IT consulting company, including SAP's portfolio	Project manager
Partner#3	Consultant partner with focus on ecosystem strategy	Founder/CEO
Partner#4	SAP partner with focus on business intelligence	▪ CEO ▪ Project manager
Partner#5	Multinational IT provider offering and enhancing the SAP product portfolio	▪ Partner manager for SAP ▪ Project manager
Partner#6	Small partner focused on managed business applications	CEO
Partner#7	IT consultancy with focus on the insurance industry	Project manager
Partner#8	Multinational IT provider and consultancy with focus on the insurance industry	Project manager
Partner#9	Global full stack IT provider offering and enhancing SAP's portfolio	Manager for SAP service offerings
Partner#10	US-based provider of IT services, including IT consulting and operations services	SAP alliance manager
Secondary Data		
Type	**Description**	
Partner workshop	▪ Full-day workshop in May 2018 with approximately 100 participants from the partner ecosystem ▪ Discussion of preliminary results in a workshop session and informal conversations	
Documents	▪ 55 documents (partner agreements, guidelines, price lists) ▪ 5 videos from developer conferences (2.5 h)	

Table 29. Overview of Data Sources

To analyze or data, we first created open codes related to different activities and decisions of SAP and its partners (Glaser/Strauss 1998; Urquhart 2013). Then, we clustered open codes into subcategories. These subcategories covered different manifestations of how partners coped with the introduction of the platform and how SAP reacted.

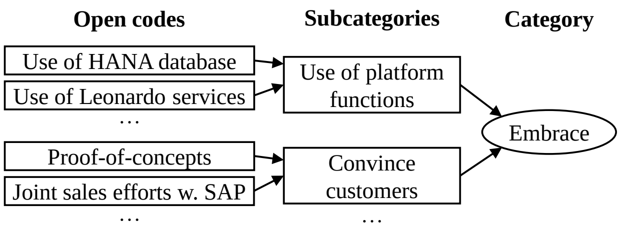

Figure 18. Excerpt from the Coding Scheme

We then grouped these subcategories to four core categories that describe distinct coping strategies of the partners and mediating activities of SAP. Finally, we conducted theoretical coding to relate the partners' coping strategies with the platform owner's mediation strategies. Excerpts from the coding scheme related to the category "enable" as a coping strategy are shown in

Figure 18. Throughout the coding process, we applied the principle of constant comparison (Urquhart et al. 2010), that is, we confirmed relationships that emerged in the selective coding step by getting back to the data and the open codes.

8.4 Case Description: SAP's Shift to the Cloud

SAP is a multinational software company focusing on ERP software. SAP collaborates with numerous partners to develop, run, and sell its enterprise software. As customers expect end-to-end solutions for their business processes, SAP faces a huge number of heterogeneous requirements across partners, industries, and countries. For example, SAP needs to fulfill requirements of industry-specific processes as well as country-specific regulations. Partners can help SAP to address these specific requirements, as the product owner of the platform illustrates:

> *"[…] the fundamental motivation [for partnering] is that our portfolio does not cover end-to-end, thus, extending our services with partners is important. The customers want an end-to-end process. Therefore, it is necessary to integrate third parties into the process. […]"*

In early 2013, SAP has established a cloud-based software platform for third-party applications that extends the enterprise software core provided by SAP. The platform provides APIs and a software development kit (SDK) that grant developers access to functions such as production data analysis or forecasting algorithms and support them in developing applications. As a result, an ecosystem of third-party developers has emerged on the platform:

> *"Based on the [platform], new applications, apps, as well as extensions of existing applications can be built in the cloud. […] Somewhat like an innovation layer for established, rather slowly ticking systems of SAP. […] I think this is the benefit one could see, because we not only enable customers to do this but we also enable partners to develop such applications on the platform and this in turn creates an ecosystem."* (product owner of SAP's platform)

SAP expects its existing partners to adopt the platform by migrating their extensions to the cloud or developing new cloud applications. According to SAP, its platform has many advantages for the partners. First, it is open to various common technologies such as programming languages or database technologies. In former on-premises environments, partners mostly had to use SAP's proprietary technologies for developing extensions. Second, the platform comes with a plethora of services that can be used by partners, in particular in the context of business analytics, Internet of Things (IoT), and machine learning. Third, by offering applications on the platform, partners can directly reach a global customer base of SAP users.

However, shifting to the platform entails major changes for partners. From a technical perspective, partners need to work with new technologies, in many cases technologies that the current employees are not familiar with. From an organizational perspective, providing software as applications on a platform needs a reconfigured business model and sales approach. At the same time, there still is uncertainty in how far the platform is consistent with what the partners' customers want. As a result, partners develop different strategies how to cope with the changes that the platform comes along with.

8.5 The Partners’ Coping Strategies

In our study, we identified three coping strategies that partners applied when SAP introduced its cloud-based software platform. Partners (1) embraced, (2) slowed down, or (3) repurposed the change that was triggered by the platform (Table 30).

Coping strategy	Description
Embrace	Partners adopt the platform early and create innovative partner solutions on the platform. *Manifestations:* ▪ Partners offer applications in the platform’s app store and leverage state-of-the art technology provided by the platform ▪ Partners promote and sell the platform to their customers by demonstrating use cases ▪ Partners actively provide feedback to improve the platform
Slow down	Partners hesitate to adopt the platform and try to slow down the change. *Manifestations:* ▪ Partners promote the advantages of the existing, non-platform solution that is still used by the majority of their customers ▪ Customers hesitate to adopt the platform, leading to a chicken-egg-problem
Repurpose	Partners use the platform for purposes that are not core of SAP’s platform strategy. *Manifestations:* ▪ Partners use the platform as toolbox for customer-specific developments instead of modular cloud apps ▪ Partners engage in consulting to facilitate onboarding in the platform ecosystem

Table 30. Partner Coping Strategies

8.5.1 Embracing the Change

A group of partners embraced the introduction of the platform as a long overdue move to increase the competitiveness of SAP and its partner network as a whole. Those partners value the opportunity to use state-of-the art technologies to provide innovative solutions to their customers. As a result, these partners were the first of the existing partners to develop applications for the platform. We observe different manifestations of activities and decisions that are part of the embrace strategy.

First, partners adopting the embrace strategy generally have already provided an innovative application in the platform’s app store. To do so, they often use the innovative services available on the platform as out-of-the-box tools. A global IT provider that offers and enhances SAP’s portfolio illustrates:

> *“In digital transformation projects with our customers, we are working intensively on what we call "Innovation by add". In these projects, the core process is still mostly running in the standard systems and the "Innovation by add" runs on the [platform]. […] As an example, when it comes to monitoring vibration of machines, we attach vibration sensors to machines, record the vibration pattern, transmit them to the [platform], and learn from them with machine learning. We also have the opportunity to monitor the machines and make a maintenance order if something has to be changed on these machines. It's actually these cloud extensions that help the customers to transform.”*

Second, partners actively promote the platform to their customers. By preparing and demonstrating use cases that the customers can relate to, the partners can illustrate the value of the platform. The above quote shows that the partner presents *"Innovation by add"* cloud applications to the customer who then decides whether that use case is beneficial for them. If so, the implementation of the use case comes along with an implementation of SAP's platform, sold by the partner acting as SAP's reseller. Thus, partners that embrace the change directly contribute to the sales of the platform.

Third, we observed that partners who adopt the platform early also actively engaged in a dialogue with SAP to improve the platform. According to some partners, the platform was launched at a rather early stage and benefitted a lot from the feedback the partners provided:

> *"Well the technical maturity of the [platform] is a matter of debate […]. We developed on the [platform] from the very beginning […] and obviously, a lot was still missing, we don't need to sugarcoat that. […] But, we generally collaborate closely with SAP, we have weekly sync calls and we discuss these issues."* (project manager of a large IT consulting firm)

8.5.2 Slowing Down the Change

A second group of partners hesitated to adopt the platform and even engaged in activities to slow down the change. A paradigm shift such as the shift to the cloud is a longsome endeavor in the enterprise software industry because many customers have legacy enterprise software and follow a "never change a running system" strategy. Furthermore, still many companies fear losing control over their data when using cloud software. As a result, according to a survey of a large user group, only 9 % of the surveyed companies plan to invest in SAP's cloud-based enterprise software suite in 2018.

Partners who currently are successful by customizing the SAP on-premises products and developing extensions for them thus have little incentive to switch to the cloud-based software platform as long as enough customers stick to the on-premises solution. The CEO of a consultancy with focus on ecosystem strategy highlights:

> *"After all, many customers have a bit of skepticism about the cloud, they see data loss and consider the whole thing from a risk perspective – especially SMEs [small and middle-sized enterprises], which are widespread in Germany. Usually their IT department wants to keep sovereignty over their data and processes. That's why, of course, partners slowed down a bit because when their customers are not asking for a cloud, it's hard to tell them that cloud is the right answer for the use case and the problem."*

Partners even go further by promoting the benefits of the older non-platform solution to their customers while keeping quiet about the potential of the cloud solutions. In particular, small and middle-sized customers do not have direct communication with SAP but rely on partners to suggest and implement solutions. This creates trade-offs:

> *"There are many add-ons that are out-of-date but the customer is still happy with them. In some cases, the functionality now is part of the standard SAP platform offering, meaning the customer would not need the add-on any more. But the cus-*

> *tomer has to realize that and then still has to implement the new cloud-based solution. This would be probably done by the same partner who developed the old add-on in the first place – but this partner is still earning money with the add-on. The partner won't say 'trash the add-on and switch to cloud component X'. You can see the conflicts created here."* (CEO of consultancy for SAP partners and customers)

This leads to a chicken-egg-problem: small and medium-sized companies hesitate to adopt cloud solutions, thus the SAP partners they work with do not promote cloud solutions to them. As it is mostly the partners who have the voice towards the small and medium-sized customers, it is hard for SAP to break that cycle.

8.5.3 Repurposing the Change

A third group of partners used the platform but did not implement complementary applications, which is the main purpose of the platform according to SAP. We observed two manifestations of how partner repurposed the introduction of the platform to benefit from it. First, partners used the platform as a toolbox for customer-specific developments instead of developing applications and offering them in the platform's app store. Partners emphasized that cloud applications are not suitable to implement processes related to a customer's competitive advantage:

> *"With software-as-a-service offerings, what use cases can you cover? Those that are not unique selling points of companies. […] there is a gap between core processes and what really is the unique selling point of a company. And for this gap, I see custom development happening also in the long run, that interacts with software-as-a-service products."* (project manager of a large IT consulting firm)

Furthermore, sales of customer-specific projects on the platform is easier for partners because it is similar to the sales approach the partners used for on-premises projects. Selling cloud applications through the platform's app store would ultimately require changes to the partners' business models. Therefore, some partners use small cloud applications that are listed in the app store as way to attract customers for customer-specific projects but not as a scalable sales channel for a generic app.

A second manifestation of the repurposing strategy refers to partners that offer consulting services for other partners that want to onboard the platform. According to SAP, onboarding has become much easier with the platform because applications can be implemented and marketed faster. However, the ecosystem around the platform is complex due to its history of technological changes and acquisitions and makes it difficult for partners to find the best strategy. One partner summarizes:

> *"Then, the cloud products came but unfortunately they were rather complex. First there was the [1st generation platform], then the [ERP in the cloud] and now the [2nd generation platform]. And that is confusing because those are not the only cloud products of SAP as SAP by now has acquired several firms such as [cloud solution for procurement], which also is a cloud platform, [cloud application for travel management] which is a software-as-a-service offering and [cloud-based ERP for SMEs] which is also marketed as cloud solution."*

Consequently, consultancies have specialized in supporting partners to develop a cloud offering based on SAP's platform. For example, they provide frameworks and boilerplates based on the platform's boundary resources to develop applications more quickly. The CEO of such a consultancy summarizes:

> *"We have created a 'mini ecosystem' to enable SAP's partners to develop native apps for the cloud platform. We take care of the onboarding, legal implications, licensing issues, and the choice of an operating mode."*

Such 'mini ecosystems' are inconsistent with SAP's effort to create a harmonized ecosystem on its platform. They create additional dependencies for partners, making the ecosystem more complex – which in turn can increase the perceived need of partners for additional consulting services.

8.6 The Platform Owner's Mediation Activities

In an ideal situation, all partners would adopt an embracing strategy with regard to SAP's platform. However, impressions from our interviews as well as from a partner workshop with more than 100 participants show that many partners slow down or repurpose the change introduced by the platform. SAP thus tries to identify mediation activities to also benefit from partners that embrace the platform and to help partners that do not use the potential of the platform (Table 31).

Coping strategy	Related mediation activities
Embrace	▪ Evaluate and implement suggestions for improvement ▪ Leverage as use cases to illustrate benefits of the platform to other partners
Slow down	▪ Build illustrative use cases with partners and end-users ▪ Engage in dialogue with partners to understand adoption barriers ▪ Increase pressure for adoption
Repurpose	▪ Adapt the platform strategy to provide enhanced support and tools for customer-specific development ▪ Reduce complexity of cloud offering, particularly regarding licensing and resource provision

Table 31. Mediation Activities

To benefit from partners that embrace the implementation of its platform, SAP engaged in two main activities. First, SAP evaluated the partners' feedback on the platform and implemented some of their suggestions. Thereby, SAP focused on large partners as they have direct communication channels. Asked about whether SAP incorporated their feedback, a project manager of one partner stated:

> *"You just need to look into the release notes. One example: We built a micro-service landscape and one specific issue was the versioning of micro-services, how can you do that and how does that work well with continuous delivery. We discussed that with SAP and then they wanted our feedback on their proposed solution and now, since a few weeks ago, there is an out-of-the-box versioning of artefacts built in the platform SDK's [software development kit] delivery pipeline."*

Second, SAP leveraged use cases of partners that established an innovative cloud application as success story to incentivize other partners. These success stories are then shared on the website, at developer conferences, or directly with partners. For example, at the developer conference in 2017, an on-stage interview with a provider of solutions for human resource management showcased the success of the cloud application the provider had launched.

Partners that adopted a slow down strategy with regard to the platform required more of SAP's attention. To convince those partners to adopt or at least try out the platform, SAP built illustrative use cases with those partners that were already on the platform. Thereby, SAP could demonstrate that the platform enables new business models for partners. Furthermore, SAP engaged in a continuous dialogue with partners through various feedback channels such as developer conferences and partner events and direct exchange with partner managers. But SAP also increased the pressure on its partners to adopt the platform for example by announcing discontinuation of support for certain on-premises solutions.

For partners that repurpose the shift towards the platform, SAP has engaged in two mediating activities. On the one hand, SAP has acknowledged the role of the platform for customer-specific developments and has adapted the platform strategy to provide more support and tools for customer-specific development. For example, by continuously increasing the technological openness of its platform, SAP has made it easier for partners to use the platform as a toolbox. A developer from SAP's platform team summarizes:

> *"[…] we are more open with the [platform] because [we] know we cannot deliver top of the breed in every aspect and there are a lot of strong open source communities developing simple things like a syntax highlighted editor […] but also complex things that allow you to do machine learning and NLP [non-linear programming] […]. And [the platform] really offers you the capability to deploy such modules – sometimes written in node [node.js; JavaScript], sometimes written in Java. […] [the platform] is really opening up and moving away from the trend of just allowing [proprietary languages] […] and that is the openness we provide."*

On the other hand, SAP is trying to reduce the complexity of its platform ecosystem. For example, SAP rebranded the platform in 2017 to harmonize the ecosystem, from the nomenclature of services to pricing for resources. In this process, SAP can benefit from the experiences of the consulting firms that currently help partners to onboard the platform.

8.7 Discussion

The insights of our case study show that partners of enterprise software vendors adopt different coping strategies with regard to the shift to the cloud. Partners embrace, slow down, or repurpose the implementation of a cloud-based software platform. The platform owner then can engage in mediation activities to address these reactions. These findings contribute to IS literature on platform ecosystems, in particular to recent work on the emergence of platform ecosystems and the role of partners for platform strategy in the enterprise software industry.

8.7.1 The Process of Partner Migration to the Cloud

The findings of our case study show that not all existing partners of a company adopt a newly introduced platform in a straightforward way. Instead, migration of partners onto the platform is a process that includes partners' coping strategies and the platform owner's mediation activities, in some cases leading to a partner dropping out of the ecosystem (Figure 19).

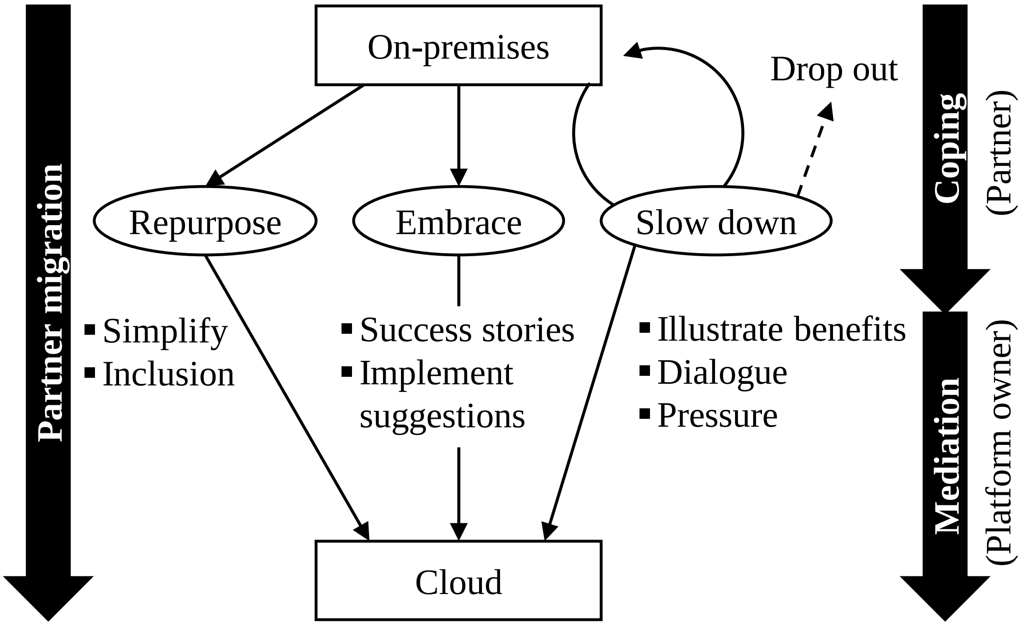

Figure 19. Process of Partner Migration to the Cloud

Partners are important for companies in the enterprise software industry (Sarker et al. 2012; Grabski et al. 2011), thus it is important to keep existing partners during the shift to the cloud. Existing partners can be of more value than new partners because they have their own customer networks and know-how to best combine their solutions with the offering of the enterprise software vendor. It is thus not only important to understand how new partners can be incentivized to join the platform ecosystem (Kude et al. 2012; Rickmann et al. 2014; Dellermann et al. 2017) but also to understand how existing partners can successfully migrate. Yet, there might be partners who are so reluctant to adopt the platform that their slow down strategy negatively affects the growth of the ecosystem. In those cases, it is be best for the platform owner to let them go.

The process of partner migration to the cloud represents an aspect of platform governance that companies such as enterprise software vendors need to incorporate in their governance strategy when implementing cloud-based software platforms. We thereby enhance literature on platform governance (e.g., Tiwana et al. 2010; Huber et al. 2017) that mainly focus on established platform ecosystems.

In practice, this process view on partner migration helps enterprise software vendors to increase the adoption of a platform among its existing partners. The first step is to acknowledge that partners react differently to the change and that the platform owner needs to take different actions to support them. In a second step, the enterprise software vendor can improve the platform by carefully observing why partners want to slow down the change or how they repurpose the platform.

8.7.2 The Impact of Repurposing on Platform Strategy

Another finding of our study is that a large share of the partners repurposed the platform and used it for customer-specific developments instead of implementing software-as-a-service applications. This had an impact on the platform owner's platform strategy and its platform governance.

Customer-specific development decreases the scalability of the platform ecosystem, as it does not trigger network effects. While cross-side network effects are typical for software platforms and a key to their success (Parker/Van Alstyne 2005), customer specific projects usually are not visible to other ecosystem participants, thus they do not incentivize other customers to join the platform. As a result, despite a high number of partners using SAP's platform, the number of applications available in the app store is still lower than in other competing platform ecosystems.

It became clear that partners who repurposed the platform still contributed to an increased adoption of the platform and were of significant value for the platform owner. SAP thus adapted its platform strategy to incorporate customer-specific development on the platform. For example, SAP increased the compatibility of the platform with the company's proprietary programming language used typically used for on-premises projects. However, SAP still struggled to find an approach to platform governance that incorporates both partners that develop software-as-a-service applications and partners that develop customer-specific solutions.

First, the two groups of partners require different boundary resources. Partners that develop customer-specific solutions need more support for different programming languages and frameworks to integrate heterogeneous legacy systems. For partners that develop software-as-a-service application, leaner, more standardized boundary resources can prove more useful (Förderer et al. 2018b).

Second, customer-specific developments are not subject to output-oriented control mechanisms such as quality checks as they are not submitted to the app store (Manner et al. 2013a). In order to not jeopardize the platform's reputation, the platform owner needs to identify other means to ensure quality, for example through mandatory participation in partner programs.

8.8 Limitations and Future Research

Our study is subject to limitations. First, generalizing results from single case studies is challenging. We have studied an enterprise software vendor with a focus on enterprise resource planning. In other context such as the industrial Internet of Things (Schreieck et al. 2017a) or the banking industry (Schreieck/Wiesche 2017), relationships between partners and platform owners could have different characteristics. Second, our study covers a relatively short period. While interviewees mostly have shared insights into partner's coping strategies, a longitudinal perspective could help to carve out more details of a migration process and to understand how partners adjust and adapt their coping strategies.

We suggest two avenues for future research. First, it would be worthwhile to analyze what characteristics of partners are linked to different coping strategies. This could help platform owners to apply mediation activities precautionary and to increase platform adoption. A second research theme relates to how platforms need to be designed and governed to enable both software-as-a-service applications and customer-specific development (Huber et al. 2017). Tradeoffs regarding boundary resources or control mechanisms arise that platform owners, particularly in business-to-business context, need to consider.

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Part B2:
Working Papers

9 Transforming Capabilities for Platform Ecosystems: The Case of Enterprise Software (P6)

Title	Transforming Capabilities for Platform Ecosystems: The Case of Enterprise Software
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Publication	Journal of Information Technology
Status	Under review, second round
Contribution of first author	Problem definition, research design, data collection and analysis, interpretation, reporting

Table 32. Fact Sheet Publication P6

Abstract

Established companies in the enterprise software industry are increasingly shifting towards a platform ecosystem strategy. By leveraging cloud technologies, companies expect to benefit from collaboration with a broad range of third-party developers within a platform ecosystem. To succeed, these companies need to transform their organizational capabilities. While literature on platform ecosystems acknowledges this need, the process of transforming capabilities has not been studied in detail. Therefore, we conduct an exploratory case study of an enterprise software vendor that has successfully established a platform ecosystem. We show that the company transformed its capabilities through iterative changes to the capabilities' underlying routines. The iterative routine changes thereby were of (1) accelerating, (2) scaling, (3) deregulating, and (4) aligning nature. As a result, platform ecosystem capabilities such as ecosystem management or platform evangelism emerge. Our findings enhance work on dynamic capabilities in the context of platform ecosystems by providing specific characteristics of the capability transformation process down to the level of routine changes. Furthermore, we add specific platform ecosystem capabilities to the literature on IS capabilities. Practitioners can build on our work when evaluating whether to implement a platform ecosystem and when identifying suitable actions to do so.

9.1 Introduction

In recent years established companies in the enterprise software industry have started to build platform ecosystems to leverage broad networks of third-party developers for value co-creation. These companies leverage cloud technologies that allow third-party developers to easily implement applications complementary to the core enterprise software, and customers to quickly deploy these applications (Lawton 2008). With this platform ecosystem strategy, established companies compete with digital-native entrants, such as Salesforce, that have successfully entered the enterprise software market with cloud platforms (Baek et al. 2014). Many established companies, however, struggle to identify effective strategies to implement platform ecosystems and to imitate the success of digital-native newcomers.

Established companies need to rethink the way they are doing business and transform their organizational capabilities accordingly to become successful platform owners: First, they need to leverage technologies such as cloud computing or database technology for real-time processing of large data sets. Established companies often adopt these new technologies rather slowly because established technologies continue to generate the lion's share of the companies' profit (Fuentelsaz et al. 2015a). Second, established companies need to adapt their capabilities related to collaboration with partners as "traditional principal-agent relationships are replaced by arms' length relations between app developers and platform providers" (De Reuver et al. 2018, 2). Third, marketing and selling software shifts from direct sales channels to online channels such as a platform's online marketplace (Sarker et al. 2012). Established companies need to leverage online sales channels without losing the value of a global network with direct access to customers. Thus, implementing platform ecosystems requires established companies to transform their organizational capabilities across the technology, governance, and market level of their business.

Literature on dynamic capabilities and capability transformation acknowledges the importance of capability transformation when organizations face environmental turbulence (Schreyögg/Kliesch-Eberl 2007; Teece et al. 1997; Lavie 2006a). By changing underlying routines, established companies can transform their capabilities and respond to challenges created by technological change or market dynamics. With the advance of information technology, transforming capabilities to leverage information systems such as IT platforms has become crucial for organizations across industries (Karimi/Walter 2015; Pavlou/El Sawy 2006).

While IS researchers have identified capabilities required for the successful implementation of IT platforms, our understanding on the process how established companies can develop these capabilities remains limited. For example, the capability to govern platform ecosystems through control mechanisms (Goldbach/Benlian 2014, 2015b), or the provision of boundary resources to third-party developers (Eaton et al. 2015; Ghazawneh/Henfridsson 2013) has been discussed in literature on IT platforms. Specifying these capabilities is valuable but does not throw light on the process of how established companies need to transform their organizational capabilities to successfully implement platform ecosystems (De Reuver et al. 2018). This limited understanding is particularly critical in the enterprise software industry, where more and more established companies launch IT platforms.

To address this gap, we embark on an exploratory case study to understand the process of capability transformation that unfolds when an established company in the enterprise software industry implements a platform ecosystem. The company we study is *IS-Corp*[19], a multinational enterprise software vendor. With the latest version of its core software product, *IS-Corp* has established a platform ecosystem for third-party developers who create complementary applications. By applying grounded theory methodology (GTM) procedures we trace the process of capability transformation during *IS-Corp's* shift to a platform ecosystem strategy. We show that *IS-Corp* transformed its capabilities across the technology, governance, and market level of the ecosystem. To do so, IS-Corp changed the capabilities' underlying routines.

By interpreting our results, we identify an iterative process of routine changes that exhibit (1) accelerating, (2) scaling, (3) deregulating, and (4) aligning characteristics. This pattern of iterative routine changes as part of a capability transformation process contributes to literature on dynamic capabilities. By providing insights down to the level of organizational routines, we enhance our understanding as to how companies that face pressure through fast technological progress can transform their capabilities. In addition, we identify five key capabilities that emerged as result of the capability transformation: cloud-based modularization, open IT, ecosystem management, platform evangelism, and platform co-selling. These specific capabilities add to literature on IS capabilities by illustrating how generic IS capabilities manifest in the context of platform ecosystems.

9.2 Theoretical Background

As recommended for exploratory case studies, we develop a theoretical pre-understanding of the phenomenon under study (Walsham 1995). The pre-understanding was iteratively enhanced during the analysis phase as we went back and forth from literature to data analysis (Urquhart/Fernandez 2013). The relevant theoretical domains cover: (1) recent theoretical insights on platform ecosystems, (2) organizational capabilities in IS that are relevant for platform ecosystems, and (3) theoretical contributions on capability transformation in IS.

9.2.1 Platform Ecosystems

Technological progress changes how organizations innovate and create value. Global connectivity through standard protocols and the advance of cloud technologies (Bharadwaj et al. 2013) enable digital interconnection between products and processes within and across industries (Rai/Tang 2014). More and more companies strive to leverage this interconnection to create platform ecosystems. Platform ecosystems center around an IT platform which we define as "[…] the extensible codebase of a software-based system that provides core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate" (Tiwana et al. 2010, 676). The underlying change from monolithic to modular software architectures facilitates collaboration of the platform owner with complementors, that is, third-party developers that create complementary applications or extensions (Tiwana et al. 2010). The platform owner, complementors and customers form a platform ecosystem around the IT platform itself. Key terms related to platform ecosystems are summarized in Table 33.

[19] Anonymized

Term	Definition	Sources
IT platform	"The extensible codebase of a software-based system that provides core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate."	Tiwana et al. (2010, 676), Baldwin/Woodard (2009)
Application (app)	An add-on software subsystem or service that connects to the platform to add functionality to it. Also referred to as a module, extension, plug-in, or add-on.	Parker et al. (2017), Tiwana (2014)
Interfaces	Specifications and design rules that describe how the platform and applications interact and exchange information.	Tiwana (2014)
Platform owner *Complementors* *Customers*	Main stakeholder groups of IT platforms. The platform owner is an individual or organization representing the legal entity that owns the platform. Complementors are individuals or organizations that develop one or more applications for the IT platform (also referred to as third-party developers). Customers are individuals or organizations that use the applications available on the IT platform. Also referred to as end-users.	Tiwana (2014), Evans et al. (2006)
Platform ecosystem	The platform and the applications specific to it as well as the stakeholders of the platform. Also referred to as platform-based software ecosystem or software ecosystem.	Cusumano/Gawer (2002), Tiwana (2014)

Table 33. Definition of Key Terms Related to Platform Ecosystems

Within platform ecosystems, the mode of collaboration changes as arms' length relations between the platform owner and complementors replace traditional principal-agent relationships with partners (De Reuver et al. 2018). The focus of value creation shifts from linear value creation in supply chains to value co-creation within networks of companies facilitated by IT platforms (Fuentelsaz et al. 2015a). According to the resource-based view, value co-creation is based on the combination of complementary resources and capabilities across companies (Ranjan/Read 2016; Smedlund 2012). It is thus required, that firms share knowledge and assets for successful value co-creation—based on governance structures that frame the companies' collaboration. (Grover/Kohli 2012). With value co-creation, companies aim to become more innovative because they lack innovative capabilities and want to benefit from the creativity of complementors such as third-party developers (Boudreau 2010; Yoo et al. 2010; Yoo et al. 2012).

Consequently, IS researchers analyze and discuss how to set up and govern platform ecosystems in order to successfully co-create value with third-party developers. For example, studies have been published on the optimal degree of openness of IT platforms (Benlian et al. 2015; Ondrus et al. 2015), the balance of openness and control (Boudreau 2010; Ghazawneh/Henfridsson 2013), or the role of boundary resources to facilitate value co-creation on IT platforms (Ghazawneh/Henfridsson 2013; Eaton et al. 2015).

While these results have contributed to establish an abstract understanding of platform ecosystems in IS research, they are of limited help to address the challenges of enterprise software vendors that establish platform ecosystems. First, most authors focus on platform ecosystems that are already successful such as Google's Android platform or Apples iOS platform. Insights into the process of how established companies can successfully create platform ecosystems are limited. Second, most platform ecosystems that have been under study are large-scale business-to-consumer platforms. These platforms exhibit ideal characteristics for studying the effects of platform economics such as direct and indirect network effects (Bakos/Katsamakas 2008) or the 'chicken-egg problem'(Evans/Schmalensee 2010). Opposed to that, enterprise software vendors face smaller, more fragmented markets, more complex software systems and the criticality of the solutions for the customers inhibit platform logic to unfold its full effect. It is thus a worthwhile endeavor to empirically study the process of enterprise software vendors establishing a platform ecosystem.

9.2.2 Organizational Capabilities in IS

According to the resource-based view of the firm, the success of organizations and their projects such as the establishment of platform ecosystems is linked to their resources and capabilities (Amit/Schoemaker 1993; Barney 1991). With the shift towards an information society and the advance of IT, capabilities, skills, and knowledge gain importance compared to resources. Accordingly, the knowledge-based theory of the firm emerges, demoting the resource-based view (Dosi et al. 2000; Grant 1996; Kogut/Zander 1992). Based on the knowledge-based view of the firm, competitive advantage requires both the exploitation of existing internal and external company-specific capabilities and the exploration of new capabilities (Teece/Pisano 1994). Organizational capabilities can be broadly defined as a firm's ability to conceive, implement, and exploit its resources to perform a particular productive activity (Mata et al. 1995; Amit/Schoemaker 1993). Capabilities thus describe the effect of an organizations's knowledge, experience and skills (Jacobides/Winter 2012).

IS literature provides considerable theoretical support for the assertion that an organization's performance is directly linked to its capabilities (Mithas et al. 2011; Mithas et al. 2012; Ravichandran/Lertwongsatien 2005). Few articles specifically discuss what capabilities are relevant for the success of platform ecosystems (for one notable exception refer to Tan et al. 2015). Still, an understanding of IS capabilities is helpful to identify capabilities required for platform ecosystems. Therefore, we provide an overview on organizational capabilities discussed in IS literature (Table 34). The capabilities can be clustered according to three levels of analysis: (1) technology, (2) governance, and (3) market (cf. Grover/Kohli 2012; Mithas et al. 2011).

Level	Capability	Description	References
Technology	IS infrastructure	A company's ability to mobilize and deploy IT assets including hardware, software, and networking technologies in combination with other resources and capabilities.	Bharadwaj (2000), Bhatt/Grover (2005), Wade/Hulland (2004)
	IS technical skills	A company's ability to leverage the employees' up-to-date skills related to hardware and software.	Bharadwaj (2000), Bhatt/Grover (2005), Wade/Hulland (2004)
	IS development	A company's ability to implement solutions based on new technologies along with an alertness towards new technologies and trends.	Pavlou/El Sawy (2006), Wade/Hulland (2004)
	Cost-effective IS operations	A company's ability to run IS operations efficiently and cost-efficiently.	Bharadwaj (2000), Wade/Hulland (2004)
	IS planning and change management	A company's ability to anticipate technological changes and plan the usage of IS accordingly.	Feeny/Ives (1990), Wade/Hulland (2004)
Governance	External relationship management	A company's ability to organize and optimize the relationship between its IS function and external stakeholders.	Bharadwaj et al. (1999), Wade/Hulland (2004)
	Dyadic IT customization	A company's ability to set up idiosyncratic IT interfaces for relationships with partners to exchange information and to collaborate seamlessly.	Rai et al. (2012), Rai/Tang (2014)
	IT network standardization	A company's ability to leverage modularized IT resources and standards to optimize collaboration with partners.	Rai/Tang (2014)
	Digital business innovation	The ability of independent ecosystem participants to set up and coordinate to jointly explore new avenues of business model innovations supported by IT.	Venkatraman et al. (2014)
	Outside-out IS capabilities	Outward-facing IS capabilities that focus on activities and processes outside of the focal company that create more value for external partners than for the focal company.	Tan et al. (2015)
Market	Customer management	A company's ability to understand customer requirements and expectations and to respond to them.	Coltman (2007), Liang/Tanniru (2007), Mithas et al. (2011)
	Market responsiveness	A company's ability to collect, process and leverage information from external sources to respond to changes on the market the company addresses.	Overby et al. (2006), Wade/Hulland (2004)
	E-marketing	A company's ability to combine IT resources, human resources, and business resources for successful marketing though digital channels.	Trainor et al. (2011)

Table 34. Summary of Organizational Capabilities in IS

On the **technology** level, we summarize capabilities that refer to a company's abilities to leverage IT for their business activities. In particular, we classify IS infrastructure, IS technical skills, IS development, cost-effective IS operations, and IS planning and change management as capabilities on the technology level (Wade/Hulland 2004). These capabilities show that technological capabilities do not only focus on software, hardware, and connectivity but also on employees who interact with IT and on processes like operation or development. While some of these capabilities such as IS infrastructure clearly are of relevance for platform ecosystems, it remains an open issue which technological capabilities are most relevant for the successful implementation of platform ecosystems and how they interact with each other.

Capabilities on the **governance** level comprise a company's abilities related to interfirm relationships and the support of these relationships by IT. According to the classification by Wade/Hulland (2004), the aspect of interfirm relationships is represented by the capability of external relationship management. This management of external relationships describes the ability to organize and optimize the relationship between IS function and external stakeholders. Other studies provide further details on governance capabilities. For example, the seemingly opposing capabilities of tailoring IT to specific interfirm relationships (dyadic IT customization) and leveraging modular IT for standardized interfirm relationships (IT network standardization) have been laid out (Rai/Tang 2010, 2014). Governance capabilities include outside-out capabilities, that is, outward-facing IS capabilities that focus on activities and processes outside of the focal company that create more value for external partners than for the focal company (Tan et al. 2015). Given the emergence of platform ecosystems in the enterprise software industry, the question arises how governance changes when the locus of external relationships shifts from partner alliances to platform ecosystems.

While the technology and governance level of analysis are addressed in most studies on organizational capabilities in IS, the **market** level is rarely addressed. Capabilities on this level are related to a company's relationship to the customer and how IT helps to fulfill the customers' expectations. In addition to customer management capabilities (Mithas et al. 2011; Liang/Tanniru 2007; Coltman 2007), market responsiveness (Wade/Hulland 2004; Overby et al. 2006) and e-marketing capability (Trainor et al. 2011) have been discussed as market-level capabilities that rely heavily on IT. From the era of packaged software, vendors in the enterprise software industry typically have highly-developed market-level capabilities, leveraging broad partner networks for direct sales. With the shift towards software provision through the cloud, vendors need to enhance their existing market-level capabilities with the new possibilities platform ecosystems offer.

The summary of organizational capabilities discussed in IS literature shows that for the successful implementation of platform ecosystems, capabilities on the technology, governance and market levels are relevant. What specific capabilities are required and how they interact across the levels of platform ecosystems remains largely unclear.

9.2.3 Capability Transformation and Routines

Established companies face continual technological change. They not only need to know what capabilities are relevant to embrace changes but also how existing capabilities can be transformed to better respond to new challenges (Lavie 2006a; Bharadwaj et al. 2013). Established companies usually possess a set of highly developed capabilities, which they could leverage to address changes in the environment. In the context of platform ecosystems, the vast majority of research analyzes platforms as given, stable systems and does not focus on the process of creation of the platform ecosystem or how the platform owner's capabilities evolve. We therefore analyze literature on capability transformation and dynamic capabilities to build up a theoretical pre-understanding of capability transformation. This pre-understanding will help us to analyze the process of capability transformation in our case company.

The notion of capability transformation allows researchers to focus on the dynamic development of capabilities as a response to technological change (Lavie 2006a; Helfat et al. 2007). To understand transformation processes of capabilities, it is necessary to analyze the capabilities' underlying routines and how they change (Lavie 2006a), taking into account the sociomaterial characteristic of organizational change (Gaskin et al. 2014). Routines are the basic building blocks of organizational capabilities (Arikan/McGahan 2010; Winter 2000) and can be defined as managerial and organizational processes, that is, "the way things are done in the firm" (Teece/Pisano 1994, 5). With the combination of routines as part of a capability, organizations can address the complex problems they face (Schreyögg/Kliesch-Eberl 2007). By changing the underlying routines, organizations can transform their capabilities to react to turbulences in the environment such as the emergence of new technologies (Figure 20). In a generic way, routine changes comprise modifying, discarding and acquiring routines (Lavie 2006a). More specific insights on how routines can be changed successfully are lacking as only few studies go as deep as the routine level to analyze capability transformation.

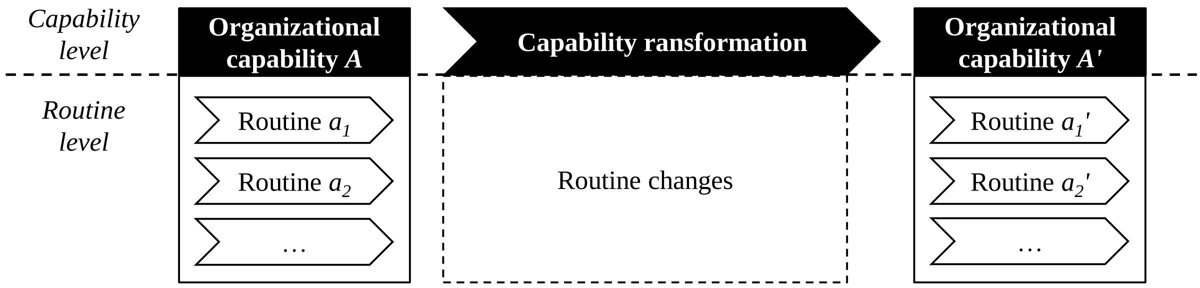

Figure 20. Theoretical Pre-Understanding on Capability Transformation

The notion of capability transformation is closely related to the dynamic capabilities view (Teece/Pisano 1994; Teece et al. 1997). Dynamic capabilities refer to organizations' ability to "integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al. 1997, 516). Thus, dynamic capabilities are necessary to actually conduct capability transformation. The term capability transformation goes a step further and includes the methods that established companies need to apply in order to develop capabilities. The methods thereby indicate how the capabilities' underlying routines can be modified (Lavie 2006a).

IS research postulates that IT can provide organizations with increased flexibility, thereby improving their dynamic capabilities (Drnevich/Croson 2012). At the same time, researchers acknowledge that organizations need competencies to leverage IT – which in turn comprise dynamic capabilities (Pavlou/El Sawy 2006; El Sawy et al. 2010). This circular phenomenon, referred to as "digital ecodynamics" (El Sawy et al. 2010, 835; cf. Jacobides and Winter 2012), captures the interaction of changes in the environment, dynamic capabilities and IT, underlining the importance of both dynamic capabilities and IT to address new challenges. A twofold perspective on dynamic capabilities and platform ecosystems is appropriate. On the one hand, a platform ecosystem's underlying platform can increase the platform owner's dynamic capabilities (Sebastian et al. 2017). Through the collaboration with a large number of third-party developers, new markets can be addressed quickly; the platform owner shares the risk with the third-party developers and remains flexible. On the other hand, if one focuses on the emergence of a platform ecosystem, the to-be platform owner needs dynamic capabilities to change existing organizational routines and capabilities (Karimi/Walter 2015). As the enterprise software industry is currently undergoing a transformation towards platform ecosystems, the latter perspective entails more pressing issues, ultimately leading to the question how an established vendor successfully implements a platform ecosystem.

In sum, the theoretical pre-understanding on capability transformation illustrates that we need to analyze routine changes to understand the process of capability transformation of established companies that are creating a platform ecosystem. Existing literature on capability transformation and dynamic capabilities does not focus on platform ecosystems specifically and often lacks analyses that go down to the level of routines.

9.3 Research Methodology

To address our research question on the process capability transformation for established companies in the enterprise software industry, we conducted an exploratory case study on the enterprise software vendor *IS-Corp* (Yin 2014; Walsham 1995). Taking on an interpretivist stance (Goldkuhl 2012), we collected qualitative data and adopted procedures of GTM for coding and interpreting the data (Glaser/Strauss 1998; Wiesche et al. 2017).

An exploratory case study based on GTM procedures is suitable for two reasons. First, the subject of our study, established companies in the software industry that adopt a B2B platform ecosystem strategy, is a recent phenomenon that is dynamically evolving. It is thus advisable to study this phenomenon in its context with an iterative interplay of data collection and analysis (Seidel/Urquhart 2013; Urquhart 2013). Second, understanding essential capabilities for platform ecosystems and the process of reconfiguring existing capabilities represents a theoretical gap. Due to the heterogeneous and young field of platform theories (De Reuver et al. 2018), an exploratory, grounded approach to study capability transformation is promising for theory development (Urquhart et al. 2010).

9.3.1 Case Selection and Overview of Case Data

We selected the case of *IS-Corp* for our exploratory case study for several reasons. First, *IS-Corp* has been a successful incumbent in the enterprise software industry by leveraging partner alliances. The ongoing shift towards a platform ecosystem strategy has been referred to as the most significant change in the company's history. Therefore, the case of *IS-Corp* allows us to study how the company transformed its capabilities during this change. Second, the platform project is a central element of *IS-Corp's* strategy. Thus, *IS-Corp* provides the necessary resources to come up with the required capabilities. Third, *IS-Corp* had experimented with different IT platform projects in the past and the current platform ecosystem strategy incorporates the experiences gained in these projects. Their platform ecosystem strategy is likely to be more successful than the strategy of an established company that implements its first platform.

Our case data includes both primary and secondary data covering the period from October 2015 to February 2018 (Figure 21). While *IS-Corp's* platform project (which we will refer to as "*IS-Corp* platform") was initiated as early as 2012, it started to gain more traction towards the end of 2015. This suggests that the period of our study is suited to analyze how capabilities have been transformed.

To gather primary data, we conducted interviews, as interviews allow to extract the participants' interpretations of the phenomenon under study (Walsham 1995). We conducted semi-structured interviews (Gläser/Laudel 2009) with employees and external workers involved either in the traditional partner alliances strategy or in the platform ecosystem strategy. In total, we conducted 32 interviews with 33 interview partners between February 2016 and February 2018 (see Table 61 in Appendix E). The interview partners include the company's vice president responsible for the platform project, the chief architect and the product owner of the platform as well as other employees of *IS-Corp* and partner companies of different sizes involved in the project. The interviews lasted 61 minutes on average. The interview questions covered the basic principles of both the partner alliances strategy and the platform ecosystem strategy, the challenges and benefits associated with the shift from the former to the latter, and the way *IS-Corp* changed its organizational practices (see Table 61 in Appendix E). All interviews were recorded and transcribed.

We furthermore collected secondary data on the case. In particular, we gathered material *IS-Corp* had made available for developers in the developer portal, internal presentations on the platform project, investor relations documents, reports on recent acquisitions performed by *IS-Corp*, press releases, and videos of presentations at important events for the *IS-Corp* community. We enhanced this data with entries from different technology blogs related to *IS-Corp*. We obtained this data by crawling the technology blogs based on keywords related to the *IS-Corp* platform. In total, the secondary data covers 1,387 pages of documents, 2.5 hours of video material and 155 entries of tech blogs (see Table 62 in Appendix E).

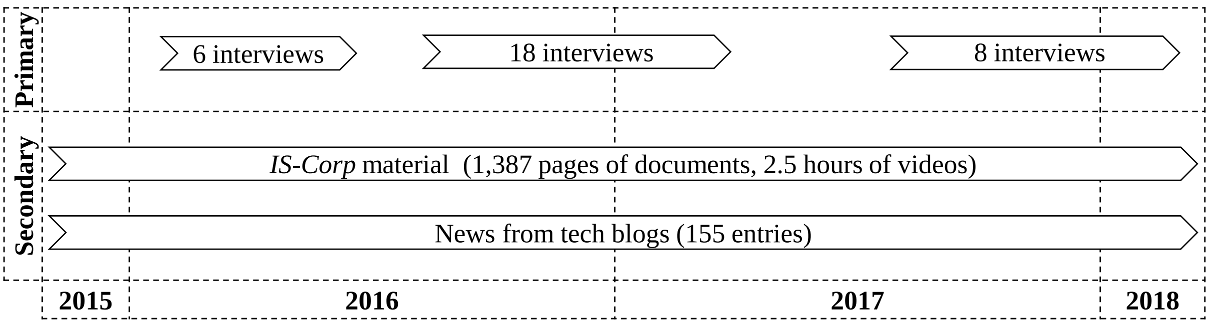

Figure 21. Overview of Case Data

9.3.2 Data Analysis and Coding

We conducted the analysis of our data in an open-minded way, without upfront constructs or hypotheses. During the process of analysis, capability and transformation emerged as relevant constructs and we iteratively went back to literature on capabilities to substantiate our analysis (Urquhart/Fernandez 2013). For the analysis, we followed the Glaserian approach to coding (Glaser/Strauss 1998; Glaser 2005). We started with open coding and created 649 codes associated with 902 interview quotes. Using selective coding, we clustered open codes into subcategories and categories. We thereby built on coding families provided by Glaser (1978, 2005). In particular, we adapted the coding family *Process* to capture the transformation of capabilities. To get a holistic understanding for the transformation process, we also used the elements context, causes, and consequences from the *Six C's* coding family (Figure 22; cf. Day et al. 2009) . Several categories and sub-categories emerged for each element of the coding family. For example, the category *technological change* represented a key *cause* for the transformation and included several sub-categories such as *emergence of cloud technologies*. The coding scheme is further illustrated in Table 63 in Appendix E.

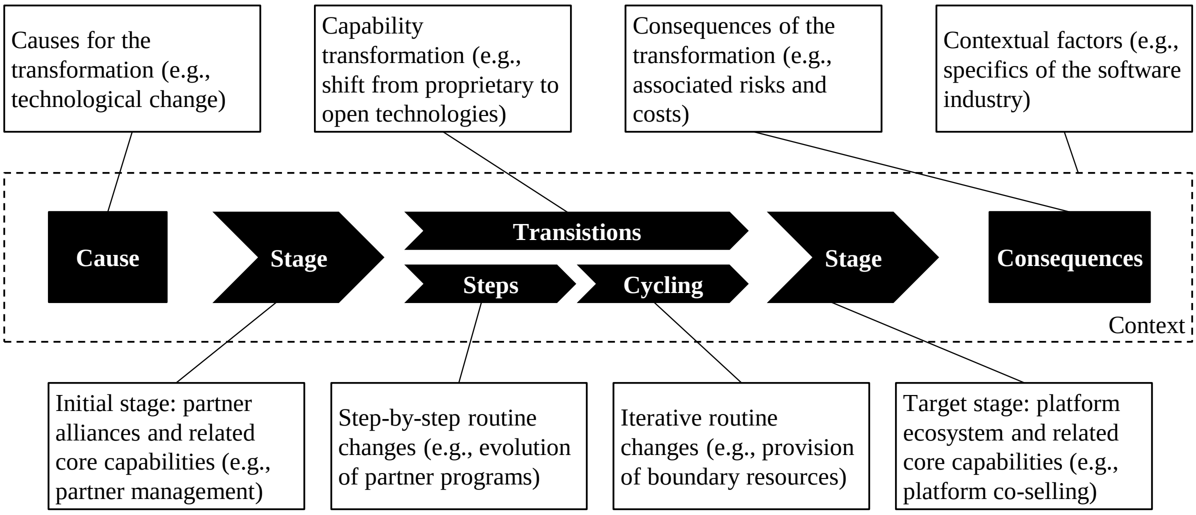

Figure 22. Coding Scheme based on the Glaserian Coding Families Process and the Six C's (Glaser 1978, 2005)

Subsequently, we conducted theoretical coding to understand the relationships between categories and to be able to link these results to our theoretical pre-understanding. Following the principle of constant comparison (Urquhart et al. 2010), we returned to the data whenever a relationship emerged in the theoretical coding to verify that it is sufficiently grounded in the data. We created 24 memos throughout the analysis of our data to write up our ideas on relationships between categories and to note areas of inquiry for subsequent interviews (Urquhart et al. 2010).

9.4 Analysis of *IS-Corp's* Capability Transformation for Platform Ecosystems

In this section, we first introduce the case of *IS-Corp* and its shift to a platform ecosystem strategy. We then describe how *IS-Corp* transformed its capabilities to establish a successful platform ecosystem. The capability transformations are located at the technology, governance, and market level of the ecosystem. We trace capability transformations by unfolding the underlying routine changes.

9.4.1 Case Synopsis – *IS-Corp* Shifting to a Platform Ecosystem Strategy

IS-Corp is a multinational software company focusing on enterprise software. In this study we examine the transformation of *IS-Corp's* traditional partner alliances strategy towards a platform ecosystem strategy, driven by the advance of cloud technologies and pressure from platform-based competitors such as Salesforce (Baek et al. 2014).

The traditional **partner alliances strategy** emerged in the 1990s with the success of *IS-Corp's* enterprise software solution. The software was used across various industries, regions, and companies of different sizes. As customers expected end-to-end solutions, the software needed to consider characteristics of industry-specific processes as well as country-specific regulations such as fiscal or data protection laws. To address the resulting heterogeneous customer needs, *IS-Corp* collaborated with a network of selected strategic partners that provided extensions for the core software products, a strategy common for vendors of enterprise software (Grabski et al. 2011; Sarker et al. 2012). *IS-Corp* relied on partners that filled white spaces in the product portfolio with extensions that, for example, offered additional functionality or localized products. To ensure seamless processes at the customers, the extensions were deeply integrated into the core enterprise software. One of *IS-Corp's* partner program managers summarizes:

> *"[…] the fundamental motivation [for partnering] is actually always that our portfolio does not cover end-to-end, thus extending our services with these partners is important. The customers want an end-to-end process. Therefore, it is necessary to integrate third parties into the process. […] This has, on the one hand, technological reasons, if we consider, for example, highly technological solutions: build-time applications that run directly on machines – that is knowhow that [IS-Corp] does not possess. […]. On the other hand, in the end, it is the business case. If there is a relatively small market, [IS-Corp] usually would not want to implement the specific solutions on its own."*

With the latest version of its enterprise software, *IS-Corp* has shifted to a **platform ecosystem strategy**. The advance of cloud technologies allows for modular third-party applications that customers can flexibly add to their core enterprise software, even during runtime. With that shift, *IS-Corp* has opened its enterprise software to third-party developers by establishing a cloud platform for complementary applications (we refer to this platform as "*IS-Corp* platform"). On the cloud platform, third-party developers can collaborate with *IS-Corp* through standardized channels building on application programming interfaces (APIs) and further boundary resources such as documentation, sample applications, and video tutorials. Thereby, *IS-Corp* aims at leveraging the skills, expertise, and innovative capacity of numerous third-party developers within a platform ecosystem:

> *"Based on [the IS-Corp platform], new applications, apps, as well as extensions of existing applications can be built in the cloud. […] Somewhat like an innovation layer for established, rather slowly ticking systems of [IS-Corp]. […] I think this is the benefit one could see, because we not only enable customers to do this but we also enable partners to develop such applications on the platform and this in turn creates an ecosystem. Thus, [the IS-Corp platform] is an enabler of innovation, that's how one can put it. It supports the creation of great new solutions for digital transformation, thus it is also an enabler of digital transformation" (Product manager of the IS-Corp platform)*

While the shift to a platform ecosystem strategy emerged rather consistently across interview partners, interviewees reported problems implementing the strategy. The shift required a change in *IS-Corp's* capabilities and routines. Leading managers involved in the platform project referred to this change as a *"huge organizational challenge"* and a *"process that overthrows* *organizational practices”*. To understand the organizational challenge and how it can be resolved, we analyzed how *IS-Corp* transformed its capabilities and the underlying routines across the technology, governance, and market level of the ecosystem.

9.4.2 Transforming Capabilities on the Technology Level

On the technology level, two main capability transformations emerged: (1) from IT integration to cloud-based modularization and (2) from proprietary implementation to open IT.

The first capability transformation, from **IT integration** to **cloud-based modularization** refers to changes in the collaboration between *IS-Corp* and third-parties from a technological viewpoint. IT integration, as part of the partner alliances strategy, entailed a deep embedding of partner extensions into *IS-Corp’s* core enterprise software. The strategic partners were granted access to the core of *IS-Corp’s* enterprise software solution and integrated their extensions similar to native components developed by *IS-Corp*. One partner manager of *IS-Corp* summarizes:

> *“[…] there is a very deep integration with [IS-Corp], there are many dependencies with [IS-Corp] components, so that the [extension] can be considered a[n] [IS-Corp] component itself. You cannot develop that downstream or separated, you need to see it as one integrated system. We are world champions in integration and it’s the integration that counts; that the [extension] adheres to our standards has to be enforced in the course of the development.”*

The partner manager’s quote illustrates that the development cycles of the core enterprise software and the extensions were closely coupled to ensure quality standards. In order to support partners in the process of developing and integrating their extensions, *IS-Corp* provided a development model to which partners had to adhere. *IS-Corp* consulted the partners on how to achieve the required quality levels and even engaged in joint development efforts if necessary. A chief partner expert summarizes these routines:

> *“The development model and development standards we provide are well established and provide, to a certain degree, a high level of security – in order to create marketable products. Accessibility is one of our [development] standards […] in addition to maintenance, functional correction, compatibility to other [IS-Corp] products. These standard requirements, to which partners must adhere – or argue why they don’t, need to be approved by us, have emerged from long years of experience and have proven eligibility. A partner with less development experience is unable to build a [development] process model as comprehensive as we can.”*

In the course of shifting towards a platform ecosystem strategy, *IS-Corp* transformed its IT integration capability into a cloud-based modularization capability. To do so, *IS-Corp* restricted the access to its core system. Making the core system available to a broad range of third parties would be risky as a misuse could affect the core’s integrity and security. To enable third parties to build applications, *IS-Corp* instead developed application programming interfaces (APIs) that grant access to pre-defined functionality and data of the core system. *IS-Corp* was able to enforce modular applications resulting in a scalable platform ecosystem that can incorporate a large number of third-party applications.

At the same time, *IS-Corp* relaxed the requirement for partners to follow a development model defined by *IS-Corp*, leading to a decoupling of the core system's and the extensions' development cycles. Taken together, these routine changes led to a new routine that relates to connecting modular third-party applications through APIs. This routine change significantly accelerates the process of third parties contributing their solutions to the ecosystem:

> *"When you have a close partnership and a joint development project, you have to coordinate things and you have a joint roadmap. However, if you find an interesting firm with a product that adds to [IS-Corp's] portfolio, and then you begin talking to the development department about forming a developer team, this takes just way too long. […] On the [IS-Corp] platform, you can get an application live within weeks" (Program director sales; IS-Corp)*

The implementation of a platform ecosystem marks the shift from deployment of *IS-Corp's* software on premises to a cloud-based deployment, a second routine of the cloud-based modularization capability. The product owner of the *IS-Corp* platform states:

> *"It is a declared objective of [IS-Corp] to be a cloud company and provide software in the cloud accordingly. And to offer applications in this network. It is a matter of scalability."*

Following that goal, *IS-Corp* first introduced hybrid deployment models that refer to deployments where customers runs the software on their own private cloud. To do so, customers nevertheless get "cloud-ready" and are able to add pure cloud services to their portfolio. This process was supported by virtualization and containerization, two methods used to abstract operating systems and applications from the underlying hardware and thus facilitate provision of software via the cloud.

The second capability transformation on the technology level, from **proprietary implementation** to **open IT** refers to changes in the technological basis of the cloud platform.

Implementation of proprietary technologies emerged as important capability of *IS-Corp's* partner alliances strategy. These technologies comprised proprietary database technologies, programming languages, and frameworks for functionality and user interfaces that *IS-Corp* has developed over the years. In addition to the technologies, *IS-Corp* supported partners to adopt these proprietary technologies. Through workshops, online courses, user groups and consulting, partners could acquire the necessary skills to use *IS-Corp's* proprietary technologies. By leveraging its proprietary technologies, *IS-Corp* stayed in control of the technologies used in the partner network and created a lock-in effect for partners. The more partners invested in skills that were idiosyncratic to its relationship with *IS-Corp*, the more likely they were going to remain a partner of *IS-Corp*.

In opposition to that routine, *IS-Corp* has based its new cloud-platform on open IT, in particular on one open source framework. *IS-Corp* not only builds on that framework but also contributes back to the open source project with both code and financial support. In return, *IS-Corp* benefits from constant improvements that the open source community contributes to the project. Furthermore, third-party developers are more likely to be familiar with the relevant technologies as the open source framework is built on popular programming languages such as Java. The large community is also helpful in solving application developers' issues. One of *IS-Corp's* developers summarizes the increased technological openness:

> *"[…] we are more open with [the IS-Corp platform] and that is also the general path that [IS-Corp] wants to follow because [we] know we cannot deliver top of the breed in every aspect and there are a lot of strong open source communities developing simple things like a syntax highlighted editor […] but also complex things that allow you to do machine learning and NLP [non-linear programming] […]. And [the platform] really offers you the capability to deploy such modules – sometimes written in node [node.js; JavaScript], sometimes written in Java. […] [the platform] is really opening up and moving away from the trend of just allowing [proprietary languages] […] and that is the openness we provide."*

A main challenge of the routine change towards open source technologies is to identify the right communities and projects that will remain relevant for years to come. For its cloud platform, *IS-Corp* invested significant amounts of time and money in evaluating options for engaging in open source projects. One of *IS-Corp's* project managers illustrated that challenge:

> *"Of course, we tried to evaluate [the potential of an open source project] objectively. The question is always, do you bet on one open source software? … one open source community? … What is the probability that this community will still be there in two to three or five years? In my opinion, the larger the scope of application, the higher the probability that it will persist."*

Closely related to leveraging open source and open technologies, *IS-Corp* further enhanced openness by making the *IS-Corp* platform compatible to different database technologies even if they are provided by competitors. The capability transformation is summarized in Figure 23.

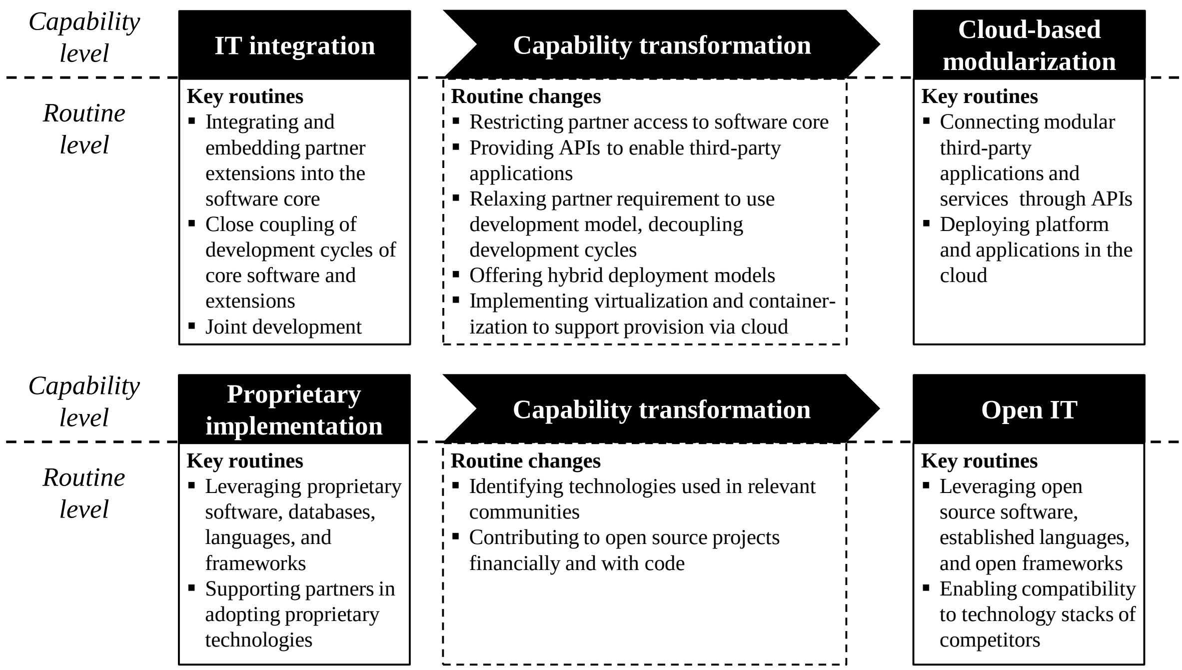

Figure 23. Capability Transformation from Partner Alliances to Platform Ecosystem – Technology Level

9.4.3 Transforming Capabilities on the Governance Level

On the governance level, IS-Corp transformed its partner management capability into two new capabilities: ecosystem management and platform evangelism.

Partner management was a key capability of the partner alliances strategy. It refers to the ability to leverage partner alliances for value co-creation. Within close collaborations, strategic partners of *IS-Corp* developed extensions to the core enterprise software to ad to *IS-Corp's* product portfolio. A crucial routine of partner management comprised identifying the right partners. Partners should fill whitespaces in *IS-Corp's* portfolio and should not be competitors of *IS-Corp* in markets for related products. At the same time, partners should have sufficient technological capabilities and experience to contribute a product that fulfills *IS-Corp's* quality standards. The potential revenue should be large enough to justify the investments in an alliance. Over time, *IS-Corp* has had numerous successful and unsuccessful alliances, accumulating knowledge on what partners are suited best for alliances, as stated by *IS-Corp's* global licensing manager:

> *"We have a dedicated team called Business Development for Partner Solutions […]. They analyze the [potential] partner solution, they know the market, and they actively get in touch with these partners. Of course, a business case is developed beforehand [to estimate] what revenue can be expected with that partner. Then, the partner is contacted and a deeper 'due diligence' is conducted. The case is presented to a larger board at [IS-Corp], they scrutinize the revenue, the potential, how the solution is framed, […] whether it overlaps with other products. Do we create competition with our own products or partner products? What does the technology look like? What is the partner's financial situation? How large is the partner? Can the partner provide 24/7-support? […] if [the board] says that this is beneficial for [IS-Corp], we will start contract negotiations."*

As further routines of the partner management capability, *IS-Corp* developed an enabling style of control to ensure the quality of partner contributions while supporting the partners with individual boundary resources. A senior director of ecosystem and channels referred to this as *"one-to-one governance"* highlighting *IS-Corp's* efforts to support the development of the partners' individual strengths – as long as they were also beneficial for the collaboration. One external partner of *IS-Corp* highlights:

> *"[…] collaboration with [IS-Corp] did particularly help us with regard to […] industrial software development […] – how to create code that is tested, that leads to the desired results for the customer, and is sufficiently documented not only for internal use but also for externals. So the customer knows what he gets. This professionalization of software development that we did not have 15 years ago as a startup […], made us more mature in a positive sense."*

With the introduction of the *IS-Corp* platform and the associated shift towards a platform ecosystem strategy, the partner management capability was transformed into two complementary capabilities: **ecosystem management** and **platform evangelism**.

To establish the ecosystem management capability, *IS-Corp* adapted the quality requirements for applications in the platform ecosystem as compared to the requirements of extensions provided by strategic partners. Not only were the criteria relaxed, but the onboarding process was also significantly accelerated. To still enforce application quality in the ecosystem, *IS-Corp* implemented standardized formal control mechanisms such as function and performance tests. Simultaneously, *IS-Corp* standardized the boundary resources provided for third-party developers and massively expanded them to facilitate and accelerate development by third parties. The individual *"one-to-one governance"* was adapted to a *"governance for the masses"* as stated by a senior director of ecosystem and channels of *IS-Corp*. One developer summarized the efforts of *IS-Corp* to provide information and knowledge on the platform:

> *"There are wikis, social media websites or blogs where people inform others about what they did; you find tutorials, Q&As, FAQs. Then there is IS-Corp's academy, a YouTube channel, which plays a key part in getting the knowledge out there on how to develop on [the IS-Corp platform] and how to get started and – even more complex – what features I can use. […] these sources provide a good starting point and if people get stuck in a problem that is deeper and it is not answered […], they can still contact the development or the representative who sold them the [IS-Corp platform] instance."*

Our analysis of *IS-Corp* revealed that ecosystem management was required but not sufficient to kick-start the platform ecosystem. To trigger third-party developers to contribute to the ecosystem, *IS-Corp* needed to develop platform evangelism capabilities, that is, the ability to rally third-party developers behind the platform. To do so, *IS-Corp* rebranded its platform with a campaign that focused on the openness of the platform and the ease-of-use for developers – an image *IS-Corp* is trying to maintain. At the same time, *IS-Corp* aimed at inspiring third-party developers with enthusiasm, for example with presentations at developer conferences, engagement with online communities, and posts on tech blogs and social media platforms. For example, one of *IS-Corp's* platform evangelists kicked off a community event by referring to the developers as characters of the Star Trek[20] universe to enthuse them for the upcoming presentation and workshops on the *IS-Corp* platform:

> *"We are assembled here today to prepare you for your exams to become future Starfleet commanders of the United Federation of Planets. You and your crew will explore strange new worlds, you will seek out new civilizations and you will boldly go where no one has gone before. As part of your exam, there is the famous and feared Kobayashi Maru challenge. Please repeat after me: 'Kobayashi Maru'!"*

The capability transformation is summarized in Figure 24.

[20] Star Trek is an American science fiction franchise based on a TV series aired in the 60s and written by Gene Roddenberry. Star Trek has inspired a cult phenomenon since then with numerous films, TV series, comics and novels around the starship USS enterprise and its captain, James T. Kirk. The Kobayashi Maru challenge that the platform evangelist refers to is part of the training of Starfleet cadets.

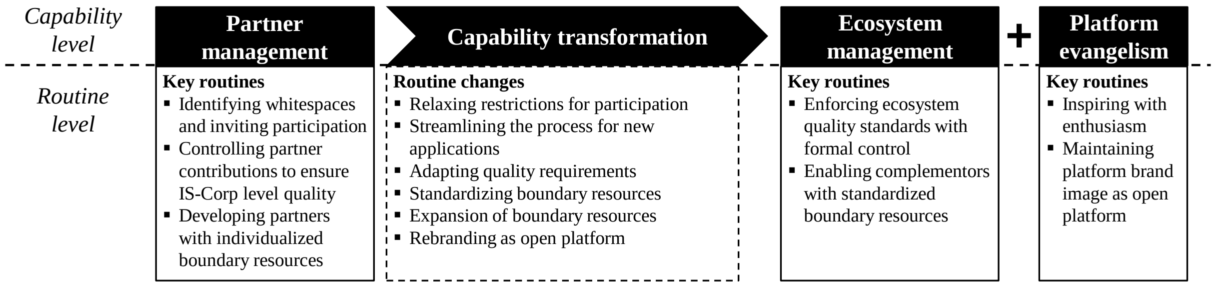

Figure 24. Capability Transformation from Partner Alliances to Platform Ecosystem – Governance Level

9.4.4 Transforming Capabilities on the Market Level

The shift towards a platform ecosystem strategy also affects the way *IS-Corp* markets its products. *IS-Corp* transformed capabilities of direct sales and partner sales into a platform co-selling capability.

IS-Corp's **direct sales** capability has been one key to market performance in the partner alliances strategy. It refers to the ability to leverage a global network for direct sales of *IS-Corp's* and the partners' products and services. Through numerous local subsidiaries, *IS-Corp* had direct access to customers around the globe and maintained direct customer relationships despite the increasing numbers of players in the partner network. As part of partner alliances, *IS-Corp* granted their partners access to these direct sales channels by including partner extensions in the sales activities:

> *"We have developed a product portfolio jointly with [IS-Corp]. We conduct joint pre-sell activities with [IS-Corp], and it is a huge advantage that a global network is available. This means we are capable of acting in South America and in Cologne or Hanover. We only need to make use of the network in the respective countries. In the meantime, we have become active globally ourselves, but I think [IS-Corp] is still more diversified and has a better network than [we] do." (External partner of IS-Corp)*

The global direct sales network was enhanced by *IS-Corp's* capabilities to enable **partner sales**. *IS-Corp* has gained a lot of experience in identifying individual measures that boost sales of partner extensions. We identified two underlying routines: The first routine relates to negotiating contracts and revenue sharing with partners. With its experience in setting up partner alliances, *IS-Corp* could make sure that it negotiated contracts that balanced its own benefits and the partners' incentives to contribute to the ecosystem in a sustainable way. The fact that many partners have been loyal for years shows that *IS-Corp* was able to set up agreements beneficial for both sides. One external partner we interviewed confirmed that he had never had the impression, *IS-Corp* offered "*adhesion contracts*" but instead created a *"win-win situation"* for itself and the partners. The second routine is the support of the partners in selling their extensions through joint sales activities such as bundling, branding, and certification. In branding, *IS-Corp* sold some extensions that are crucial for the customers under its own brand as the *IS-Corp* brand stands for a sufficient level of quality and reliability. Other extensions were included into bundle deals for specific industries in order to enhance sales figures. Still other extensions were certified by *IS-Corp* to make the quality level more credible to customers. One of *IS-Corp's* partner experts states:

> *"[We offer] a variety of sales channels […]. Typical sales channels we command are, of course, direct sales, that is, we directly address the customer: 'we have a solution of interest to you'. Then, there are different in-house exhibitions, in parts industry-specific, that are hosted by us such as the [IS-Corp] forum for banks and insurance companies, which we organized recently. Then, we participate at external exhibitions. Our partner [company] hosts its in-house exhibition every two years where we are represented. We also publish whitepapers with our partners, which make use of the Internet to market our products."*

With the shift to a platform ecosystem strategy, *IS-Corp* enhanced its direct and partner sales capability to a **platform co-selling** capability. Routine changes to develop that capability comprise increasing the transparency of partner programs and the price-lists used in direct sales activities, evaluating third-party developers' willingness to pay, and enabling pay-per-use provision and billing of resources. Those routine changes were necessary to, in the next step, establish an online marketplace for third-party applications. However, *IS-Corp* first had tried to disrupt its sales strategy related to the *IS-Corp* platform by focusing exclusively on an online marketplace as sales channel. This shift did not work out and *IS-Corp* soon had to recollect established sales models and adapt them to the platform, combining both platform and direct sales channels. A chief partner expert of *IS-Corp* stated:

> *"We realized that with regard to the [IS-Corp platform], in the beginning we did not tell the [IS-Corp platform] story right. We did have a marketplace and all, but that just didn't work for our company because our customers do not buy on an online marketplace. Instead, they have their person of trust in our sales team, whom they have confidence in, whom they buy bundles from. […] There's our sales guy saying 'dear [customer], I offer you these three packages and if you take the fourth, it's 50% off.' That's how our deals are closed."*

This statement shows that *IS-Corp* had to rebrand the *IS-Corp* platform and to adapt the sales department's incentive system which up to then was based on the direct sales paradigm. As a result of the routine changes, identifying optimal pricing across the ecosystem participants and combining platform and partner sales emerged as core routines for the capability of platform co-selling. With these changes, the success of the online marketplace increased as it has been integrated in the sales structures.

In sum, *IS-Corp* focused on leveraging the installed base of customers of *IS-Corps* enterprise software along with the existing partners to promote the *IS-Corp* platform. By using this strategy, the platform was not subject to the chicken-egg problem as the first application developed by a third-party developer could be offered to a large number of customers via direct sales. Once a customer opted for such an application, he automatically gained access to the *IS-Corp* platform and the associated marketplace where he could test and purchase further applications. This combination of direct sales and platform sales proved to be beneficial to boost the success of the *IS-Corp* platform. Over time, sales deals conducted directly on the platform gained importance compared to direct sales deals. At the time of the study, almost 1,500 applications were available on the platform's marketplace with more than 1,300 of them being offered by third-party developers. The capability transformation is summarized in Figure 25.

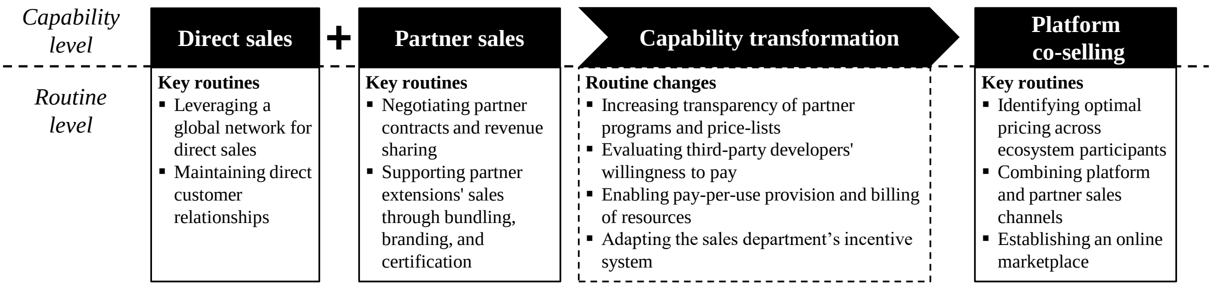

Figure 25. Capability Transformation from Partner Alliances to Platform Ecosystem – Market Level

9.5 Theoretical Integration and Discussion

The results of our case study show that software firms that shift towards a platform ecosystem strategy undergo a process of capability transformation. Based on in-depth insights into the case of an enterprise software vendor, we carved out how the process of capability transformation is essentially a result of changes to the capabilities' underlying routines. In this section, we first suggest that the routine changes follow an iterative cycle of acceleration, scaling, deregulating, and aligning of routines. We discuss how these findings extend our understanding of capability transformation in the face of the progress of IT. Second, we show that the transformed capabilities we identified enhance literature on platform capabilities. To conclude, we summarize the implications for theory and practice of our study along with suggestions for future research.

9.5.1 Capability Transformation through Iterative Routine Changes

The in-depth insights into *IS-Corp* have allowed us to analyze the process of capability transformation down to the level of routine changes. Enhancing our theoretical pre-understanding, we identified a pattern of iterative routine changes that consists of (1) accelerating, (2) scaling, (3) deregulating, and (4) aligning routines (Figure 26). We outline these types of routine changes below.

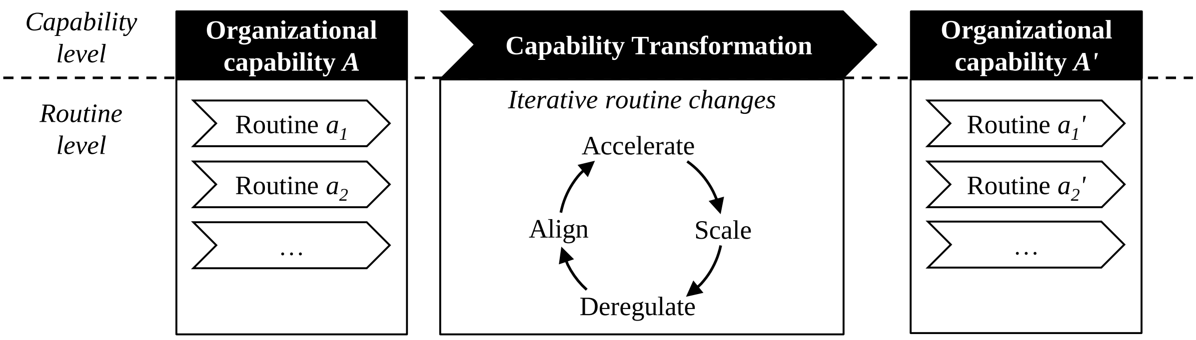

Figure 26. Revised Theoretical Understanding of Capability Transformation

Accelerate refers to types of routine changes in which routines or sequences of routines are transformed into new routines that can be executed faster or that allow associated processes to be executed faster. For example, *IS-Corp* accelerated the onboarding process of new applications on the platform by changing the routines related to both the support for third-party developers and the process of quality control. Standardized and simplified boundary resources allowed third-party developers to implement applications faster and a streamlined quality check led to faster approval of applications. These routine changes were crucial for the transformation of partner management capabilities to ecosystem management capabilities. Furthermore, accelerated routines facilitate cloud-based modularization through shorter development cycles and faster deployment, and co-selling through faster certification processes.

Scale refers to routines or sequences of routines that are transformed to enable stronger scalability of the platform ecosystem. For example, to enable third-party developers to offer scalable solutions on its platform, *IS-Corp* had to change the way it provisions and bills the resources used by partners. Instead of fixed resources agreed upon upfront, a pay-per-use approach was implemented. This significantly reduced the risk for third-party developers as they are now able to flexibly react to surges in demand for their application and no longer risk paying for unnecessary resources. This shift towards a pay-per-use billing of resources was a prerequisite development of *IS-Corp's* cloud-based modularization capability.

Align is a routine change that describes routines or sequences of routines that are aligned across the different levels of the platform ecosystem, that is, technology, governance and market. For example, *IS-Corp* realized that the online marketplace for applications had not been successful in the first run as the sales department's incentive system did not take that particular channel into account. At the same time, *IS-Corp's* customers would not search an online marketplace for applications that, as part of the ERP system, could be critical for their IT infrastructure. Instead, the customers relied on their direct contacts at *IS-Corp's* sales department. It was the alignment of marketplace activities and incentive structures that led to the first significant success of *IS-Corp's* marketplace for applications. This routine change allowed a transformation of partner sales capabilities into platform co-selling capabilities. Similarly, cloud-based modularization, open IT, and ecosystem management only take full effect when the underlying routines are aligned across the levels of the platform ecosystem.

Deregulate means that routines or sequences of routines are changed to relax restrictions and create greater openness for third-party developers. For example, with the introduction of its platform, *IS-Corp* no longer required third-party developers to couple their development processes to the release cycles of their enterprise software. This decoupling enabled cloud-based modularization as third-party developers are able to independently offer applications that are easily deployed to customers via the cloud. Similarly, a deregulation of the partner selection process was a routine change that cleared the way for a platform ecosystem and for ecosystem management capabilities to emerge. The capability to leverage open IT was mainly fueled by gradually relaxing restrictions on technologies and frameworks that can be used by third-party developers.

Across the levels of technology, governance, and market, the routine changes were implemented in an iterative way, often reinforcing each other. For example, *IS-Corp* deregulated the development process of third-party developers which in turn accelerated their development processes. *IS-Corp* then supported the development processes with standardized APIs which increased the scalability of third-party development efforts. These routine changes on the technology level were aligned with routine changes on the governance level. In particular, the process to onboard new applications was streamlined, further accelerating the process of getting new third-party applications on the market.

With our model of iterative routine changes we enrich Lavie's notion of capability transformation who identified rather generic routine changes such as "modify", "discard", and "acquire" (Lavie 2006a). We suggest that for a specific context, such as the implementation of a platform ecosystem in the enterprise software industry, specific descriptions of routine changes and their interactions are more helpful when trying to understand the ongoing capability transformation.

We furthermore contribute to the broader literature on dynamic capabilities in IS. Extending the notion of dynamic capabilities (Teece et al. 1997), we show that mastering different types of routine changes is fundamental to dynamic capabilities. These routine changes shape internal and external competences and, through their iterative implementation, enable rapid adaptions to environmental turbulence. This notion corresponds to established interpretations that dynamic capabilities support the flexible adjustment of functional IT competences in the context of platform capabilities (Karimi/Walter 2015) and IT usage in general (Pavlou/El Sawy 2006). The importance of dynamic capabilities thereby increases as the environment changes more turbulently (El Sawy et al. 2010). The shift towards cloud technologies and platform ecosystems in the enterprise software industry comes along with drastic changes, thus dynamic capabilities will be a decisive factor for established companies when they tackle that transformation. Our breakdown of the transformation process into iterative routine changes specifies the types of changes established companies need to perform to leverage their existing resources and processes for that transformation. This in-depth view allows us to take into account the sociomaterial characteristic of organizational change (Gaskin et al. 2014).

9.5.2 Platform Ecosystem Capabilities

The emerging platform ecosystem capabilities across the technology, governance, and market level also represent a contribution to literature on IS capabilities. We link the platform ecosystem capabilities to important IS capabilities. We thus break the latter, rather abstract capabilities down into a more concrete understanding of knowledge and skills required to successfully establish platform ecosystems (Table 35).

Level	Capability	Description	Related IS capabilities
Technology	Cloud-based modularization	Enabling easy development and deployment of cloud-based third-party applications.	▪ IS infrastructure (Bharadwaj 2000; Bhatt/Grover 2005; Wade/Hulland 2004) ▪ IS development capabilities (Pavlou/El Sawy 2006; Wade/Hulland 2004)
	Open IT	Building on open technologies and standards to increase the ecosystem's impact.	▪ IS planning and change management capabilities (Feeny/Ives 1990; Wade/Hulland 2004)
Governance	Ecosystem management	Enabling high-quality third-party contribution in the ecosystem.	▪ External relationship management (Bharadwaj et al. 1999; Wade/Hulland 2004) ▪ IT network standardization (Rai/Tang 2014) ▪ Outside-out capabilities (Tan et al. 2015)
	Platform evangelism	Creating a powerful vision for the platform ecosystem to incentivize third-party contribution.	▪ -
Market	Platform co-selling	Leveraging the ecosystem's sales channels through collaboration with complementors.	▪ Market responsiveness (Overby et al. 2006; Wade/Hulland 2004) ▪ Customer management (Coltman 2007; Liang/Tanniru 2007; Mithas et al. 2011)

Table 35. Platform Ecosystem Capabilities

The capabilities cloud-based modularization and open IT relate to the technology level of analysis. Cloud-based modularization refers to the platform owner's ability to enable easy development and deployment of cloud-based third-party applications. This capability is an enhancement of IS infrastructure (Wade/Hulland 2004; Bharadwaj 2000; Bhatt/Grover 2005) and IS development capabilities (Wade/Hulland 2004; Pavlou/El Sawy 2006). With cloud-based modularization, the platform owner provides an infrastructure that serves as basis for development activities that are performed by third parties or jointly with them. Open IT is a company's ability to build on open technologies and standards to increase the ecosystem's impact. This shift towards open technologies comes along with significant changes of the IT infrastructure and therefore also relates to IS planning and change management capabilities (Wade/Hulland 2004; Feeny/Ives 1990).

On the governance level of analysis, the capabilities ecosystem management and platform evangelism emerged. Ecosystem management is the platform owner's ability to enable high-quality third-party contribution in the ecosystem by governing the relationships with third-party developers. It connects capabilities that have been discussed in the past in other contexts such as external relationship management (Wade/Hulland 2004; Bharadwaj et al. 1999), which was not specifically defined for platform ecosystem relationships, IT network standardization (Rai/Tang 2014), which focusses on networks that enable ecosystem management, and outside-out capabilities (Tan et al. 2015), which generally describe capabilities that are linked to external players. The ecosystem management capability goes further than combining those existing capabilities because it also includes governance aspects such as control mechanisms to ensure quality standards within the ecosystem and the provision of boundary resources that only recently have been discussed for platforms in the enterprise software industry (Förderer et al. 2018b).

Platform evangelism is the platform owner's ability to create a powerful vision for the platform ecosystem to rally third-party developers behind the platform. Platform evangelism covers, on the one hand, the support of enthusiastic third-party developers in promoting the platform ecosystem among other potential third-party developers. On the other hand, platform evangelism refers to evangelists that are employed by the platform owner to directly engage with existing and potential third-party developers for example through keynote speeches at developer conferences or online activities on social media, forums and blogs. While the capability of platform evangelism is not directly related to IS capabilities discussed in literature, it builds on the concept of shared goals as discussed in research on open source projects and virtual communities (Bock et al. 2015). Platform evangelism and ecosystem management are closely related as third-party developers that are inspired by evangelists will be serviced by the ecosystem management team once they board the platform.

On the market level, we identified platform co-selling as core capability. Platform co-selling describes the platform owner's ability to leverage the ecosystem's sales channels through collaboration with complementors. While this capability includes aspects of the capabilities market responsiveness (Wade/Hulland 2004; Overby et al. 2006), and customer management (Mithas et al. 2011; Liang/Tanniru 2007; Coltman 2007), it is a new conceptualization of the sales capability in the context of platform ecosystems. Co-selling entails not only the choice of the right channels, campaigns and prices for the customers, but also the collaboration with third-party developers to support them in selling their applications on the platform through different channels. By offering bundle deals, certifying applications, or offering applications under its own brand, the platform owner can significantly enhance third-party developers' sales in addition to the sales on the online marketplace. In some cases co-selling can also be initiated by the third-party developer, if the customer wants to acquire a specific application but is not yet a customer of the platform owner. The customer then needs to acquire the platform together with the application.

Taken together, the platform capabilities we identified directly contribute to IS literature on platform ecosystems. First, we confirm the importance of technological and governance capabilities reflected in existing work on platform governance (Tiwana et al. 2010; Tiwana 2014; Wareham et al. 2015), control mechanisms in platform ecosystems (Tilson et al. 2012a; Goldbach/Benlian 2014), platform boundary resources (Eaton et al. 2015; Ghazawneh/Henfridsson 2013), and openness (Eisenmann et al. 2009; Benlian et al. 2015; Ondrus et al. 2015). These findings also correspond to earlier conceptualizations of platform capabilities as a set of connectivity, standards and rules (Karimi/Walter 2015). Integrating technological and governance capabilities in one framework allows us to discuss the interplay of capabilities such as the reinforcing effects between modularization and openness as well as between platform evangelism and ecosystem management.

Second, we highlight the importance of capabilities that had not been identified as key platform capabilities beforehand. We identified platform evangelism as a platform ecosystem capability that is needed to spark third-party developers' interest in the platform, a topic that has recently emerged in literature on platforms (Choudary 2015; Parker et al. 2016; Parker et al. 2017) inspired by work from the marketing domain on customer evangelists (e.g., McConnell/Huba 2002). We show that evangelism is not only a phenomenon that might occur in developer communities but also a tactic that can be leveraged by the platform owner. Our work highlights the importance of co-selling capabilities. Literature on platform ecosystems focuses on digital marketplaces as a sales channel (e.g., Liu et al. 2014; Parker et al. 2017) neglecting the potential that a collaboration between platform owner and developers entails given the platform owner's access to broad markets. This co-selling capability can be traced back to literature on partnerships in the enterprise software industry. Enterprise software vendors traditionally collaborate with their partners not only in developing add-on solutions but also in selling them (Sarker et al. 2012; Grabski et al. 2011). Bundle deals offered by the vendors to their customers and certification programs to boost partner sales were well-established before cloud platforms emerged. Established software vendors, therefore, have the opportunity to leverage their experience in co-selling activities when they implement platform ecosystems. At the same time they need to embrace the new possibilities provided by cloud platforms such as seamless provision and scaling of resources along with pay-per-use contracts and marketplaces as additional sales channels.

Third, the platform ecosystem capabilities we identified incorporate interactions with third-party developers as new partners of the platform owner. Previous work has highlighted the importance of partnerships and the development of joint capabilities within partnerships (Eisenhardt/Martin 2000; Saraf et al. 2007; Anand et al. 2010). While these contributions see close partnerships as a locus of joint capabilities, we illustrate that the ecosystem of the platform owner and the third-party developers can also represent a locus for joint capabilities, continuing a recent line of thought in IS literature (Rehm et al. 2017; Venkatraman et al. 2014; Gawer 2014). When changing organizational routines to develop platform ecosystem capabilities, platform owners have to consider the effects that these changes have on other ecosystem participants such as third-party developers. The third-party developers themselves continuously develop their capabilities by participating in the ecosystem (Selander et al. 2013). If platform owners embrace this relationship, strong capabilities can develop across the ecosystem, increasing the competitiveness of the ecosystem as a whole.

9.5.3 Implications for Theory and Practice

The implications of our study for theory are threefold. First, we contribute to literature on capability transformation and dynamic capabilities by highlighting the process perspective of such a transformation. Lavie (2006a) adopts a variance theory-based view on capability transformation although he acknowledges that the transformation itself unfolds as a process. We show that every transformation process is related to specific changes of the underlying routine bundles. This represents an extension to the dynamic capabilities view, which suggests that organizations need to have the ability to modify their capabilities but does not differentiate specific types of modifications (Eisenhardt/Martin 2000; Helfat et al. 2007). It would therefore be interesting to further detail how dynamic capabilities are linked to the specific processes of transforming capabilities. For example, it would be worthwhile to analyze how internal and external stakeholders react to the different types of routine changes and how resistance can be overcome.

Such studies require deep insights into organizations; qualitative approaches might be most suitable to shed light on this phenomenon. The integration of existing and future qualitative findings as part of a case survey could further enhance our understanding of capability transformation, not only in the context of platform ecosystems.

Second, we contribute to literature on digital platforms and platform ecosystems. By focusing on platform ecosystems in the enterprise software industry, we enhance previous work that is mostly based on large-scale B2C platform ecosystems. We highlight that organizations have to develop their capabilities to successfully establish platform ecosystems. While this need has been identified previously (e.g., Gawer 2014; Tan et al. 2015), we derive specific platform ecosystem capabilities, namely loud-based modularization, open IT, ecosystem management, platform evangelism, and platform co-selling. With these capabilities, we also add to ongoing debates on the success of platform ecosystems such as the right extent of platform openness (Boudreau 2010; Benlian et al. 2015; Ondrus et al. 2015), and the design of boundary resources (Förderer et al. 2018b) and online marketplaces (Ghazawneh/Henfridsson 2015). We show that openness on the technology layer is beneficial for platform ecosystems as both complementors and customers want to minimize lock-in effects. Because a lock-in effect is often inevitable in the context of enterprise software, platform owners try to ease that effect by relying increasingly on open technologies, providing standardized boundary resources and open online marketplaces. However, quality requirements for third-party applications are higher in the enterprise software context than in a B2C context as the applications are used for critical business scenarios. Future research could take a closer look at the tradeoff between openness and control that is inherent to platform ecosystems but particularly challenging in the enterprise software industry.

Third, despite our focus on the platform owner and its relationship to partners and third-party developers, our results have implications for the platform's customers. In the context of enterprise software, a cloud platform not only leads to a larger offer of applications for customers but also enables customers to develop applications for their own use. Customers become an active part of the ecosystem and contribute to the ecosystem's overall capabilities (Prahalad/Ramaswamy 2000). The boundary between third-party developers and customers becomes blurred, leading to the emergence of 'prosumers' (Bichler et al. 2010). Those ecosystem participants can be a promising source for innovative solutions. Adapting cloud platforms comes along with challenges for customers as well. Instead of purchasing an ERP solution that is customized to their business process, costumers need to select modular applications on top of the platform's core functions according to their needs. This can lead to a more heterogeneous landscape of applications despite the horizontal standardization of the underlying platform. Taking on the perspective of customers that adopt cloud platforms in future empirical studies would lead to a more comprehensive understanding of platform ecosystems and a re-thinking of work on pre-packaged software (Sarker et al. 2012; Ghazawneh/Henfridsson 2015).

For practitioners our findings are helpful when evaluating the existing configuration of capabilities with regard to a platform ecosystem strategy. Clinging to the wrong capabilities can be as harmful as failing to transform the right capabilities. At the same time we show the potential value that existing capabilities can have even if the environment changes drastically. With this view on their capabilities, practitioners might be able to make a better informed decision on whether a platform ecosystem strategy is the optimal choice and whether building their own platform is more promising than joining an existing platform ecosystem.

Our study is subject to limitations. First, the single case study approach challenges the generalizability of our results. While our results might not apply to all platform ecosystems, we think that the platform capabilities and routine changes we identified are valid for platform ecosystems in the enterprise software industry and, to a limited degree, to platform ecosystems in B2B markets. Second, we cannot be completely sure that the capability transformations as performed by *IS-Corp* create a sustainably successful platform ecosystem. The growth of the *IS-Corp* platform since its launch in 2012 and particularly since 2015 suggests the effectiveness of the transformation. Nevertheless, it would be worthwhile to reevaluate the capability transformation in another five to ten years.

10 From Product Platforms to Platform Ecosystems: The Role of Customers as Developers in the Enterprise Software Industry (P7)

Title	From Product Platforms to Platform Ecosystems: The Role of Customers as Developers in the Enterprise Software Industry
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Publication	Journal of the Association for Information Systems
Status	Revise and resubmit
Contribution of first author	Problem definition, research design, data analysis, interpretation, reporting

Table 36. Fact Sheet Publication P7

Abstract

In the past, enterprise software vendors have created modular software product platforms from which they create various derivative software products for customers from different industries and of different sizes. With the advance of cloud computing technologies, enterprise software vendors aim to transform these software product platforms into platform ecosystems where third-party developers can contribute innovative applications. While this approach has led to immensely successful platform ecosystems in the business-to-consumer software industry (e.g., for operating systems of handheld devices), enterprise software vendors continue to struggle to establish successful platform ecosystems. Until now, the transition from product platform to platform ecosystem, in particular in the context of enterprise software, has been understudied in the IS and management literature. We therefore conducted a multi-year, grounded theory study on SAP's transition from an ERP as product platform to a cloud-based platform ecosystem. Through the lens of platform governance, we show that platform owners should focus on customers as developers as the key actors in the ecosystem in the first phase of the transition. Once the installed base of customers as developers has grown, platform owners can direct the ecosystem towards a broader platform ecosystem, by increasing the scalability of solutions initially developed for a specific customer. Our results enhance the understanding of how platform ecosystems emerge in complex technological environments such as enterprise resource planning or the industrial Internet of Things. We add to literature on platform governance by considering the importance of customers as developers in the enterprise software context.

10.1 Introduction

The enterprise software industry is undergoing a paradigm shift: the advance of cloud computing technologies has enabled vendors of enterprise software to transform their product platforms into platform ecosystems (Cusumano 2010a; Hayes 2008). Product platforms emerged in the enterprise software industries in the 1980s and 1990s when modular software systems replaced monolithic software products (Baldwin/Clark 2000; Meyer/Seliger 1998; Meyer/Lehnerd 1997). These modular software-based product platforms allowed customers to adapt the enterprise software to their needs and run a derivative of the core product on premises.

However, while their markets demanded increasing flexibility and agility, enterprise software customers were limited by their customized software that was laborious and costly to update (Ng/Gable 2010). Simultaneously, the improving capabilities of cloud computing technologies led to the emergence of new competitors in the enterprise software industry that offered cloud-based software. Companies such as Salesforce offered a core product that was always up-to-date and could be enhanced with third-party applications that were clearly separated from the core product and deployed as software as a service (SaaS) (Baek et al. 2014).

In response to this development, established enterprise software vendors such as Oracle or SAP transformed their software product platforms into platform ecosystems with a periphery of third-party applications. But these established vendors struggle to unlock the scalability of their platform ecosystems, given: (1) the specific requirements of many of their customers; (2) the heterogenous IT legacy landscapes in which the applications in the platform ecosystem interact; and, (3) the complexity of use cases faced by developers.

To understand and solve that struggle, IS and management literature prove helpful only to a limited extent. On the one hand, product platforms in the enterprise software industry (Meyer/Seliger 1998; Meyer/Lehnerd 1997), and the role played by partners in adapting the enterprise software vendor's products to customers' needs (Sarker et al. 2012; Ceccagnoli et al. 2012) have been described in anticipation of the trend towards platform ecosystems. But the transition itself has not been studied. On the other hand, platform ecosystems that emerged in the business-to-consumer context have been discussed along with strategies appropriate to governing them (Tiwana 2014; Tiwana et al. 2010). It remains open how the context of enterprise software leads to platform ecosystems with different characteristics, requiring a different approach to platform governance.

To investigate the transition from product platform to platform ecosystem in the enterprise software industry, we conducted a multi-year grounded theory study of SAP's cloud platform. We analyzed how SAP's platform ecosystem evolved since the introduction of the initial cloud platform in 2011. Through the lens of platform governance, we identified two phases in the transition process. First, SAP embraced the role of customers as developers in the platform ecosystem to bridge the gap between customer-specific requirements and scalability in the platform ecosystem. For example, SAP aimed at ensuring compatibility to the customers' IT landscape to incentivize customers to join the platform. Second, with more and more customers developing on the platform, SAP began to incrementally increase scalability of the initial customer-specific solutions to further broaden the platform's offerings for customers as developers.

The results gleaned from this process model on the transition from product platform to platform ecosystem add to the base of literature on digital platforms. In particular, we contribute to a more nuanced understanding of platform governance in complex technological environments such as in the enterprise software industry. Including the customer as developer in the governance approach provides new opportunities for platform owners in the enterprise software industry to achieve scalability in their platform ecosystems.

10.2 Theoretical Background

To understand transitions from product platforms to platform ecosystems in the enterprise software industry, we first review literature on both concepts as discussed in IS and management literature. We then introduce platform governance as the theoretical lens applied in our study.

10.2.1 Product Platforms and the Enterprise Software Industry

Product platforms are a "a set of subsystems and interfaces that form a common structure from which a stream of derivative products can be efficiently developed and produced" (Meyer/Lehnerd 1997, 4). Product platforms were first developed in the manufacturing industry (Wheelwright/Clark 1992). With more and more products in their portfolio, the complexity in the manufacturers' production processes increased, leading to higher production costs. With a product platform strategy, manufacturers created sets of modules with standardized interfaces that could be combined to different derivatives. For example, Black & Decker redesigned its product portfolio in the 1970s based on a product platform strategy. Through standardization of the motor, switches, and housing across different tools, Black & Decker significantly reduced production costs and created a consistent brand identity. As a result, Black & Decker became the dominant player in the U.S. power tools industry (Meyer/Lehnerd 1997). Since then product platforms have become common practice in manufacturing and have paved the path towards mass customization, for example in the automotive industry, where modules from various suppliers are integrated on common platforms to create numerous variants and models – even of different brands – from a single product platform (Gawer 2014).

The concept of product platforms has been adopted in the software industry. Prior to this adaption, software was typically built as monolith. But with increasing complexity, costs skyrocketed for software vendors the more monolithic software solutions they offered in parallel. By breaking up these monoliths into re-usable modules separated by standardized interfaces, vendors created software product platforms (Meyer/Lehnerd 1997; Meyer/Seliger 1998). These modules could be easily bundled to create different derivatives of the core product.

The paradigm shift from monolithic to modular software was basis for the success of enterprise resource planning systems in the 1990s. Companies replaced their collection of monolithic software for different functions such as accounting or procurement by an integrated product platform that combined those functions as different modules (Kumar/Hillegersberg 2000). Labelled also as ‘packaged software’, vendors bundled different sets of modules for customers of different size or from different industries. Implementation partners helped customers to identify the right module, implement the module on premises and create additional modular extensions if the vendor’s offering did not cover everything the customer needed (Staehr et al. 2012).

Despite the advantages of enterprise software that builds on a product platform, customers experienced challenges when updating and modernizing their software. The implementation of large ERP systems typically was complex and costly (Kumar/Hillegersberg 2000). Although a customer could combine different modules according to their needs, most ERP implementations included customer-specific modifications and add-ons, often done by implementation partners (Staehr et al. 2012). As a result, maintaining and updating ERP systems is challenging because all modifications and add-ons need to be checked after each change to the core modules of the ERP system (Ng/Gable 2010). In many cases, maintaining and updating becomes more costly than the initial implementation. Platform ecosystems based on cloud computing technologies seem to be a promising approach to tackle these issues.

10.2.2 Platform Ecosystems

The last decade saw immense success of digital platforms across many domains of the software industry. We refer to digital platforms as IT artefacts that provide “core functionality shared by the modules that interoperate with it and the interfaces through which they interoperate” (Tiwana et al. 2010, 676; cf. Baldwin & Woodard, 2009). Due to their extensible nature, digital platforms enable the platform owner to unlock the potential of a broader ecosystem of third-party developers for value creation (Kuk/Janssen 2013; Tiwana 2014). In sum, we refer to the digital platform, its interfaces and complementary applications along with the platform’s stakeholders as a digital platform ecosystem.

The concept of platform ecosystems differs from the idea of software product platforms. The main idea of software product platforms, as is true for all product platforms, is to create derivative products from a platform core by bundling different sets of modules for different customers (Meyer/Lehnerd 1997; Meyer/Seliger 1998). In platform ecosystems, customers select from a wide range of applications that are provided by third party developers (Tiwana 2014). Instead of a derivative product, customers use the platform core in combination with a potentially unlimited number of applications that they can flexibly add and remove.

Successful platform ecosystems have emerged in the business-to-consumer software industry such as in video gaming (e.g., Cennamo et al. 2018), operating systems for handheld devices (e.g., Eaton et al. 2015), or browser add-ons (e.g., Tiwana 2015). These platform ecosystems are typically two-sided. Third-party developers on the one side leverage the extensibility of the platform to create applications for customers on the other side. A two-sided market emerges within the ecosystem (Hagiu/Wright 2015; Rochet/Tirole 2003b) as for example Google’s and Apple’s application stores on their operating system platforms. A basic characteristic of two-sided markets is that they trigger indirect (cross-side) network effects (Parker/Van Alstyne 2005). The platform becomes more attractive for one side as more actors participate on the other side. The Apple iOS platform became more attractive for customers as more third-party applications were offered in the Apple App Store. On the flip side, an increased number of customers increased the incentives for third-party developers to contribute further applications to the platform ecosystem. Once two-sided platform ecosystems reach critical mass, network effects allow them to grow fast (Evans 2009).

In the context of enterprise software, platform ecosystems are a relatively recent development. An ecosystem of third-party applications requires that large amounts of enterprise data can be easily and quickly exchanged across organizational boundaries – this has only become possible with the advance of cloud computing technologies and the increasing speed of Internet connectivity. While new entrants such as Salesforce leveraged cloud computing, existing enterprise software vendors started transitioning their software product platforms to platform ecosystems. As anticipated by Meyer/Seliger (1998), product platforms with the right platform architecture can become the basis of an ecosystem that creates large-scale innovation through third-parties. However, it remains unclear how such a transition from software product platform to platform ecosystem can be successful.

10.2.3 Platform Governance

IS scholars have discussed platform governance as key to the success of platform ecosystems (e.g., Tiwana 2014; Förderer et al. 2018b; Huber et al. 2017). We thus apply platform governance as a means to study how platform owners can successfully transform enterprise software product platforms to platform ecosystems. Platform governance refers to the "fundamental decisions of platform owners with regards to the ecosystem of complementors" (Förderer et al. 2018b, 121; based on Gawer, 2014; Tiwana, 2014; Tiwana et al., 2010). These decisions relate to how the platform owner organizes co-creation of value with third-party developers in the ecosystem and how the value is shared between the owner and third-party developers; that is, how the platform owner captures value from the ecosystem. Various mechanisms have been identified to play a role in platform governance (Table 37).

Mechanism		Description	Sources
Value co-crea-	*Openness & control*	The platform owner's balance between granting access to a platform while staying in control of what happens in the ecosystem; i.e., to ensure the quality of complementary products.	Ondrus et al. (2015); Boudreau (2010); Ghazawneh/Henfridsson (2013); Goldbach/Benlian (2015b); Goldbach/Kemper (2014)
	Provision of boundary resources	The provision of tools, documentation, events or other resources that enable value co-creation by third-party developers in platform ecosystems.	Ghazawneh/Henfridsson (2013); Eaton et al. (2015); Karhu et al. (2018); Bianco et al. (2014)
Value capture	*Revenue sharing*	Distribution of payment flows between the platform owner and third-party developers.	Hagiu (2006); Tiwana (2014); Oh et al. (2015); Suarez/Cusumano (2009)
	Absorption	The platform owner integrates third-party developers' applications into the platform's core offering.	Eisenmann et al. (2009); Parker/Van Alstyne (2018)
	Lock-in	The costs associated with migrating to a competing platform prevent third-party developers to switch, ensuring long-term value capture.	Zott/Amit (2007); Rai/Tang (2014)

Table 37. Key Mechanisms of Value Creation and Capture in Platform Ecosystems

Openness refers to "the easing of restrictions on the use, development and commercialization of a technology" (Boudreau 2010, 1851). A platform ecosystem can be opened by granting third-party developers access to the platform in order to create and market complementary applications. Platform owners can implement differing degrees of platform openness. For example, Microsoft grants access to the Windows platform for any third-party developers but Windows itself is not open to adaptions through third-parties. By contrast, in the Linux platform the underlying technology has been made completely available to developers as an open source project (Ondrus et al. 2015). In addition to openness, the mechanism of **control** is crucial. Only a suitable balance of openness and control can lead to generativity in the ecosystem while a high level of quality is maintained (Ghazawneh/Henfridsson 2013; Manner et al. 2013a; Manner et al. 2013b). A platform that is open to third-parties needs to have control mechanisms in place to ensure that the activities on the platform are beneficial for the platform ecosystem as a whole. Thus, control refers to how the platform sets and enforces standards in the platform ecosystem; for example, related to the behavior of third-party developers and the quality of their applications. Control can be divided into formal control mechanisms (e.g., input and output control) and informal control mechanisms (e.g., self and clan control) (Tiwana 2014).

The **provision of boundary resources** represents a further key mechanism for value co-creation in platform ecosystems. Boundary resources are tools, documentation, events or other resources that enable value co-creation by third-party developers in platform ecosystems (Bianco et al. 2014; Eaton et al. 2015). Most research on boundary resources focuses on application programming interfaces (APIs) or software development kits (SDKs) that support the development process of third-party developers. In these situations, boundary resources contribute to resolving the tension between openness and control (Ghazawneh/Henfridsson 2013). For example, Apple's SKD for iOS applications is available to anyone at relatively low prices and includes a number of resources that make it easier to develop iOS application. At the same time, by using the SDK, developers are pushed to adhere to certain standards such as the visual design of applications.

Revenue sharing has been studied as a governance mechanism to capture value in platform ecosystems (Hagiu 2006; Oh et al. 2015; Schreieck et al. 2016b). Revenue sharing refers to payment flows within the platform ecosystem and how these payments are distributed between the platform owner and third-party developers (Schreieck et al. 2016b). Adjustments in the revenue sharing such as subsidizing one of the platform sides can be used to support network effects and to overcome the chicken-and-egg problem in the initial phase of a platform ecosystem (Suarez/Cusumano 2009). For example, Microsoft subsidized developers to create applications on the Windows phone platform to attract more customers. After this initial subsidizing, developers then had to make money by selling application to customers or by displaying ads in the applications.

As a rather indirect mechanism for value capture, **absorption** includes measures taken by the platform owner to include functionality into the platform core, measures which were initially offered by third-party developers. Absorption can be achieved by acquiring or imitating successful third-party applications (Parker/Van Alstyne 2018; Eisenmann et al. 2009). For example, Eisenmann et al. (2009) describe how Microsoft Windows, over time, has incorporated functionality such as a music player or instant messaging, features previously provided by third-party developers. Absorption can allow the platform owner to charge higher prices for the platform or to just attract more customers, further fueling ecosystem growth. By creating **lock-in** effects for third-party developers or customers, platform owners can strengthen their position for future monetization. With lock-in, the barriers for third-party developers or customers to migrate to competitors are increased (Zott/Amit 2007; Rai/Tang 2014). Thus, third-party developers and customers continue to generate value on the platform and might even tolerate higher revenue share of the platform owner or higher prices to access the platform due to the lock-in effect.

10.3 Empirical Approach

We conducted a multi-year grounded theory study on the evolution of SAP's cloud platform to address our research question on how platform owners in the enterprise software industry can transition from product platforms to platform ecosystems (Glaser/Strauss 1967; Wiesche et al. 2017; Sarker et al. 2018). Following the engaged scholarship paradigm (Van de Ven 2007), our research was motivated by a real problem that we observed at our case company SAP through exchange with key informants: SAP's aim was to create a scalable platform ecosystem around its cloud platform—but the ecosystem did not take off as expected. Observation of this development along with SAP's strategic reaction allowed us to sketch SAP's journey from a product platform to a platform ecosystem.

The shift towards platform ecosystems is a recent phenomenon in the enterprise software industry that is dynamically evolving. It is therefore advisable to study this phenomenon in its context with an iterative interplay of data collection and analysis (Seidel/Urquhart 2013; Urquhart 2013). By taking into consideration the evolution of SAP's platform over time and SAP's learning on how to govern the platform ecosystem, our study covers a time span of seven years since the announcement of SAP's platform in 2011, including retrospective data collection.

10.3.1 Data Collection

We applied grounded theory methodology procedures for collecting and analyzing data (Glaser/Strauss 1998; Urquhart 2013; Wiesche et al. 2017). We collected qualitative interview data in two series between early 2016 and late 2018 based on theoretical sampling considerations (Walsham 1995). By conducting interviews in two distinct series, we were able to analyze how SAP's cloud platform evolved over time and how SAP adapted its governance strategy. Both series include interviews with members of SAP's platform team, partners, and customers.

We conducted a total of 61 interviews which lasted 58 minutes on average. All interviews except two were recorded and transcribed. For the interviews that were not recorded, we composed detailed memos during and immediately following the interviews. The interview questions covered the history of the platform project, the interaction between SAP, partners and customers, the projects that partners and customers implemented on the platform, and the interviewees' assessment of the platform project. While the interviews cover the timespan from 2016 to 2018, we were able to capture the whole lifecycle of the platform project since its launch in 2011 through the interviewees' retrospective (cf. Langley 1999).

In addition to interview data, we gathered secondary data such as internal presentations and meeting minutes, and publicly available documents such as business reports or news articles

(Figure 27). The news articles were collected by regularly crawling blog entries from SAP bloggers and popular tech blogs based on keywords such as ‘SAP’ and ‘SAP cloud platform’. In total, the secondary data contains 172 documents, 2.5 hours of video material, memos from two all-day workshops with partners and customers, and 189 entries of tech blogs.

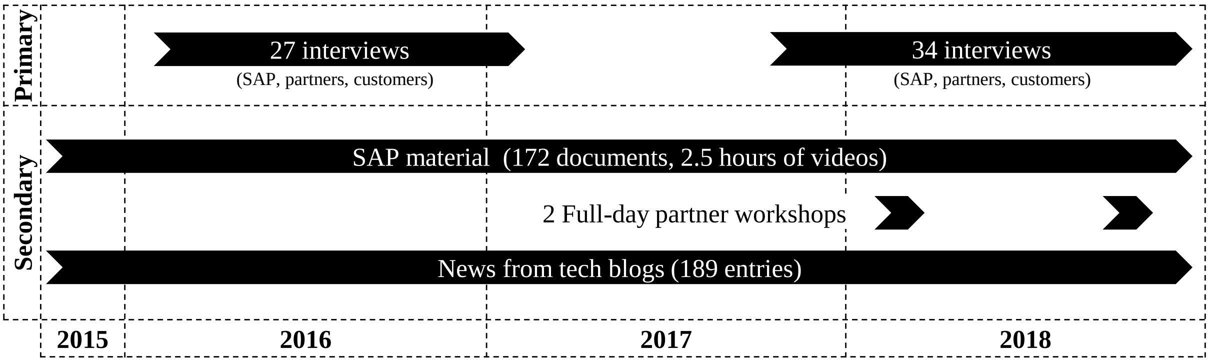


Figure 27. Overview of Case Data

10.3.2 Data Analysis

For the analysis of our primary and secondary data, we started with open coding and created more than 600 codes associated with over 900 quotes that were related to how SAP governs value creation in the emerging platform ecosystems. Using axial coding we identified categories that summarized open codes related to similar aspects of platform governance. Using selective coding we identified the core category – value creation with customers as developers – and related all categories to the core category as part of a process model. We illustrate the coding scheme with illustrative quotes in Figure 36 in Appendix F (cf. Sarker et al. 2012; Strauss/Corbin 1990).

Following the principle of constant comparison (Urquhart et al. 2010), we returned to the data whenever a relationship emerged in the selective coding to verify its grounding in the data. By creating memos during coding, we captured ideas on categories and their relationships throughout the analysis (cf. Gregory et al. 2015).

10.4 Results

In this section, we provide a description of how SAP’s cloud platform ecosystem emerged from the on-premises ERP system. We characterize the platform ecosystem and present rich descriptions of how SAP governs the transition to a platform ecosystem to create value with customers as developers and third-party developers.

10.4.1 Case Synopsis – Emergence of an ERP Cloud Platform with Customers as Developers

SAP is a German company focusing on enterprise software. Founded in 1972, SAP has become one of the most successful vendors in the enterprise software industry. SAP’s software is used by 92% of the Forbes Global 2000 companies as well as by small- and medium-sized companies (SAP SE 2018a). SAP’s most successful product is its ERP system. Launched initially in 1979, the ERP system increasingly gained importance, with its third generation becoming the de facto standard for corporate ERP from the 1990s onward.

The third generation of SAP's ERP system, an **on-premises** software, marked the transition from monolithic software towards a central ERP system in the form of a product platform. Although the core ERP system was designed to cover the standard processes of manufacturing companies, it can be bundled with various modules to create derivatives for different industries. Customers with specific requirements and from niche industries customized these derivatives further with extensions developed on their own or by associated implementation partners. Partners would, for example, offer an extension to help customers comply with country-specific tax regulations in Mexico, or an extension to help pharmaceutical companies document an uninterrupted cold chain throughout the logistics process. These extensions were typically developed with SAP's proprietary programming language ABAP[21] and directly interacted with the core ERP (Figure 28A).

With the advance of **cloud** technologies, SAP identified the opportunity to build a cloud platform as an *"innovation layer for our traditional, rather slow ticking systems"* (Product Manager at SAP). The on-premises ERP system was "slow ticking" because after customers implemented and customized the product, it became hard to update the core. For every new version, an implementation project was required to make sure that all extensions still functioned. With its cloud platform, SAP clearly separated the core ERP system from any additional functionality developed by customers or partners. The platform provides application programming interfaces (APIs) and a software development kit (SDK) to support partners and customers when implementing applications that run on the cloud platform (Figure 28B). These applications can only interact with the core ERP through the APIs. Thus, the core can be updated easily, as long as the updated APIs remain backward compatible. Applications can be developed with state-of-the-art technologies such as Java, JavaScript and HTML5.

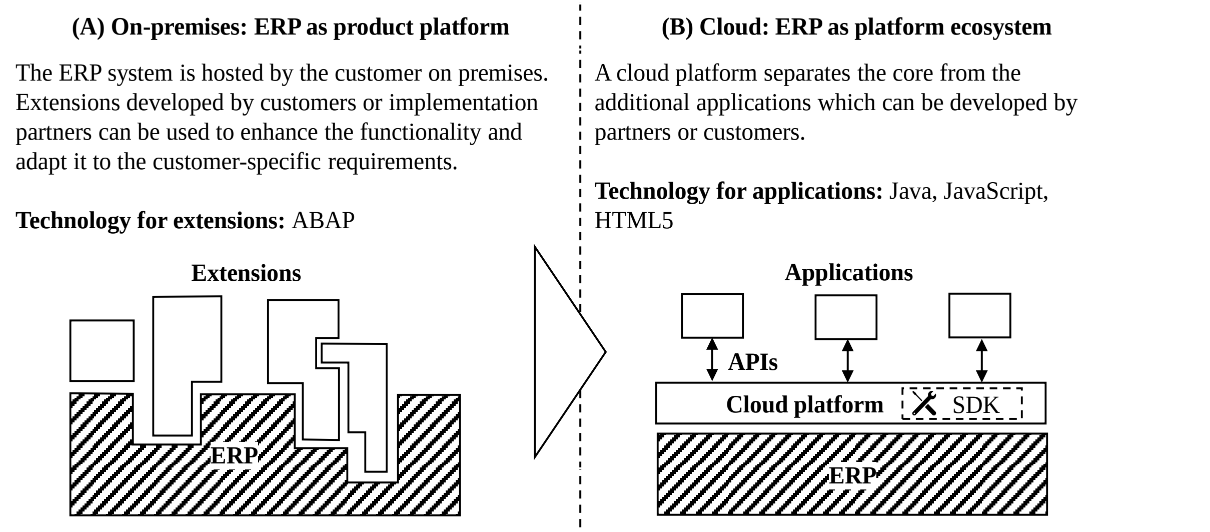
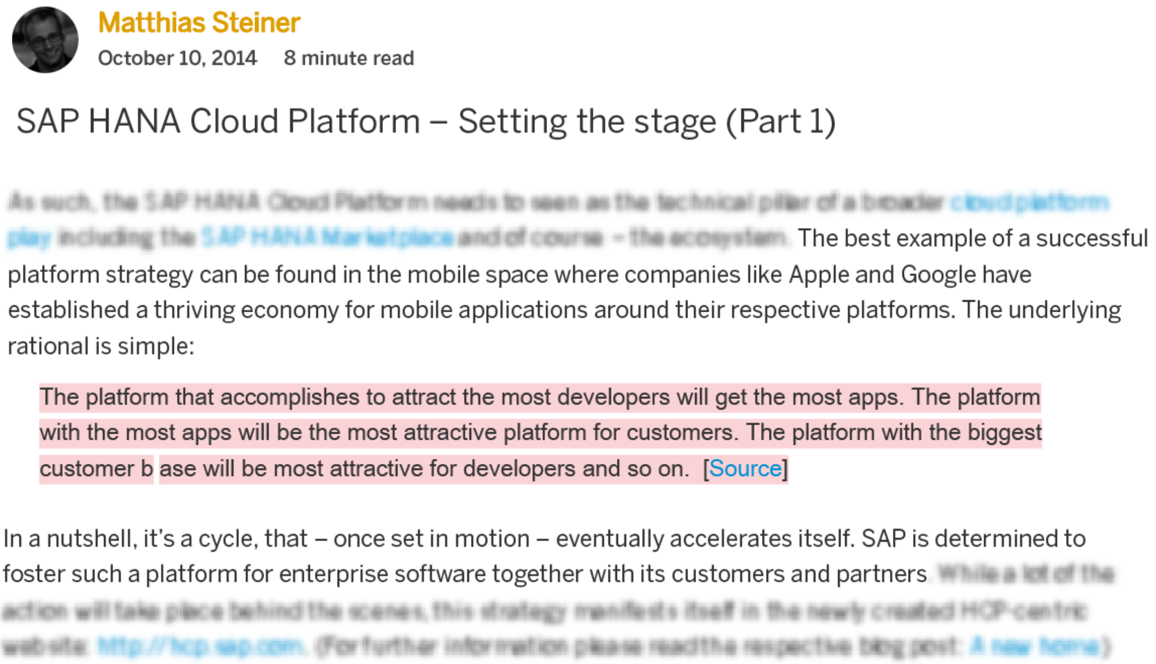


Figure 28. Technological View on SAP's Transition to the Cloud Platform

SAP launched its cloud platform in 2013 after continuously improving earlier beta versions from 2011 to 2013. From the start, SAP aimed to create a flourishing ecosystem of third-party developers. In a blog entry from 2014, one of SAP's cloud platform evangelists writes:

[21] ABAP stands for "Advanced Business Application Programming" (formerly "Allgemeiner Berichtsaufbereitungsprozessor") and is remotely similar to COBOL.



Matthias Steiner
October 10, 2014 8 minute read

SAP HANA Cloud Platform – Setting the stage (Part 1)

The best example of a successful platform strategy can be found in the mobile space where companies like Apple and Google have established a thriving economy for mobile applications around their respective platforms. The underlying rational is simple:

> The platform that accomplishes to attract the most developers will get the most apps. The platform with the most apps will be the most attractive platform for customers. The platform with the biggest customer b ase will be most attractive for developers and so on. [Source]

In a nutshell, it's a cycle, that – once set in motion – eventually accelerates itself. SAP is determined to foster such a platform for enterprise software together with its customers and partners.

Figure 29. Excerpt from Blog Entry on SAP's Official Blog (Steiner 2014)

However, the first years of the cloud platform showed that the interest of third-party developers was smaller than anticipated by SAP. Thus, the indirect network effects the blog author referred to did not have an impact comparable to the platforms for mobile applications. Instead of third-party developers offering applications, customers and their partners used the platform for internal use cases:

> *"[Third-party developers] played a minor role on the platform. It was more about internal use cases. The platform is used for an internal application or for customers that want to renew their IT landscape – an agile layer on top of their ERP systems. So, it is not the large marketplace where we have many partner applications on the platform, I don't see that."* (Member of the platform team at SAP, referring to the situation in 2015)

Reacting to that development, SAP changed its strategy in 2016 and focused platform governance on customers as developers on the platform. Only with an increasing ecosystem of customers as developers was SAP able to renew its efforts to create a third-party developer ecosystem with a relaunch of the platform in 2017. SAP's journey is summarized in Figure 30. In the subsequent sections, we illustrate how SAP's platform governance approach developed along that journey.

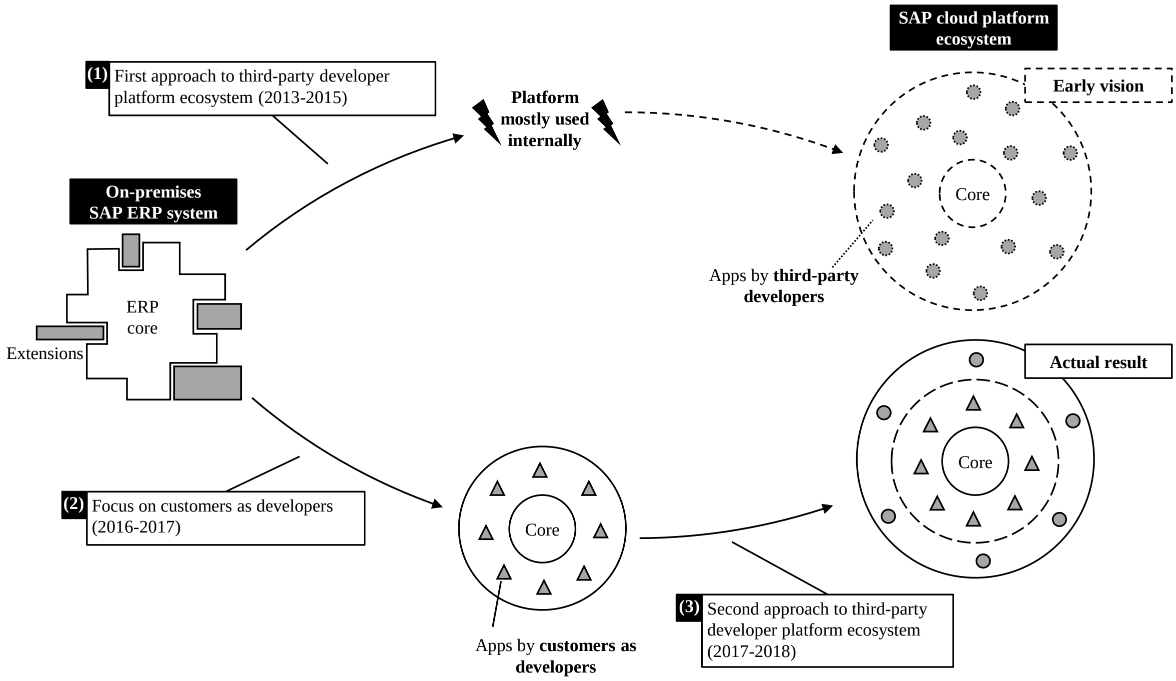


Figure 30. SAP's Journey from Product Platform to Platform Ecosystem

10.4.2 First Approach to Third-Party Developer Platform Ecosystem (2013-2015)

After publicly launching its cloud platform in 2013, SAP focused its platform governance on third-party developers. The goal was the creation of numerous applications by existing implementation partners from the on-premises age and new third-party developers and to market these applications through the cloud platform's marketplace for applications. SAP based its governance approach on what was known from successful platforms such as Apple's iOS but attempted to adapt these findings to the enterprise software context (Table 38).

Governance activities	Manifestation	Purpose
Increase triability	New, open category in the partner program to try out use cases without any costs	*Incentivize and support third-party developers*
Use open source technologies	Use of an open source cloud platform framework as basis for the platform (Cloud Foundry)	
Provide SDK	Provision of SDKs for developing applications that access the ERP core (S/4HANA Cloud SDK) and for developing iOS and Android applications	
Establish marketplace	Marketplace with global reach available as sales channel for partners	
Claim revenue share and acces fee	Third-party developers share the revenue they generate through application sales with SAP and pay a yearly access fee	*Capture value from third-party developers*
Claim certification fee	Third-party developers pay for certifications of their applications (for initial certification and re-certifications)	
Gather feedback for platform	SAP uses feedback from third-party developers to improve the platform	*Benefit from interaction*
Gain business knowledge	SAP gains domain specific knowledge from third-party developers such as what features could be added to the platform core for what industry	

Table 38. SAP's Governance Approach Targeted at Third-Party Developers (for illustrative quotes see Appendix F)

The main purpose of SAP's governance activities was **incentivizing and supporting third-party developers**; that is, attracting partners who create applications on the platform. To accomplish this goal SAP first made the process of becoming a third-party developer significantly easier through increased triability. For example, in late 2015, SAP introduced a new partner category, the 'open ecosystem' category, which allowed third parties to easily sign up for the cloud platform and develop trial applications for free:

> *"The new model is built around a tier-based system [...] Anyone interested in learning about the PartnerEdge advantage can explore the new framework commitment-free simply by joining the SAP open ecosystem and gaining limited access to basic benefits."* (excerpt from video on new partnership mode; June 2015)

The second step taken by SAP was to continuously increase the technological openness of the platform by using open source technologies. In the first years, the platform relied on proprietary technologies such as SAP's cloud platform framework *neo* and its database *HANA*. In 2016 SAP started to change the platform's underlying framework from *neo* to the open source solution *Cloud Foundry*[22]. These types of open source frameworks come with a low entry barrier as there is plenty of documentation, best practice and examples freely available on the web. Cloud Foundry also offered more flexibility regarding the technologies that can be used:

[22] Cloud Foundry is an open source cloud application platform developed by the Cloud Foundry Foundation. The foundation is supported by major IT companies such as Cisco, Google, IBM, Microsoft, Pivotal, SAP, and SUSE and aims at establishing Cloud Foundry as the standard for platform-as-a-service offerings (Cloud Foundry Foundation 2018).

> *"The new solution [on Cloud Foundry] is based on open technologies and provides more flexibility regarding technical possibilities. The advantage [of Cloud Foundry] simply is that it is newer, more flexible. With the current proprietary solution, we are limited regarding the support of runtimes, languages, and so on. For example, we support Java and JavaScript but there are many cases where someone wants to use Node.js because it scales better for scenarios with high load."* (SAP vice president)

Next, SAP ramped up its boundary resources by providing SDKs for application that interact with the core EPR suite (S/4HANA Cloud SKD) and for the mobile operating systems Apple iOS and Android. In particular the Cloud SDK was praised because it offers comprehensive development tools that cover the whole delivery pipeline:

> *"We work a lot with the SAP S/4HANA Cloud SDK, which is basically a library for Java projects and at the same time provides a delivery pipeline based on Jenkins and Docker containers. The whole topic of 'continuous everything" is already solved pretty smoothly [with the SDK]. From my point of view, SAP has provided a very powerful stack, which helped us as partners enormously. In the beginning we had tried to establish the delivery infrastructure on our own; we would have succeeded at some point, but now we have access to a powerful tool for free. And with that tool, we are able to, from a purely technical perspective, have a smooth deployment from the Git repository in the SAP Cloud Platform. The intermediate steps such as automated testing are sufficiently good that I can trust them."* (CEO of an SAP partner)

In the last step, SAP established a dedicated marketplace that third-party developers can use as a channel to market their applications. While SAP first had created different web stores to showcase applications for different SAP products (such as SuccessFactors or Ariba), they soon centralized all applications into one store, the SAP App Center. The goal was to increase the visibility of the store and to avoid confusion. Over time SAP also increased the technical capabilities of the marketplace to allow direct deployment of applications from the store.

With its governance activities, SAP furthermore aimed at **capturing value from third-party developers**. Related governance activities included SAP claiming a share of the revenue generated by third-party developers when they sell their applications. Different pricing options exist, from a fixed revenue share to transaction-based fees to customized pricing. Also, SAP claims yearly access fees from third-party developers once they want to market a solution they have built on the cloud platform. As of 2018, the basic fee for these "PartnerEdge Build" partners is 2,000 € per year (SAP SE 2018c). Third-party developers pay for certifications such as "SAP Certified Built on SAP Cloud Platform" with fees ranging from 1,500 to 3,000 € per year (SAP SE 2018b). These certifications are helpful particularly for smaller, unknown companies because the endorsement by SAP signals high quality standards.

In addition to direct monetization, SAP strived to **benefit from interaction** with third-party developers. As the owner of the platform, SAP is able to learn from the feedback of partners that are active on the platform. One partner illustrates how regular interactions with SAP improved the platform:

> *"In my opinion it is valuable to be an early adopter because now you have the possibility to, for example, bring in requirements for the S4 HANA Cloud SDK and these are then prioritized by SAP and we can see in the releases that our requirements have been implemented by SAP. […] This is not custom development, they ask for our feedback, they find it valuable, and implement it."* (technology lead for SAP's cloud platform at a partner company)

Through interaction with third-party developers, SAP gains domain-specific knowledge of different industries and is able to identify possible future use cases. By observing which third-party applications are successful, SAP can identify opportunities to add functionality to the platform core. SAP can develop such functionality internally or acquire solutions or companies to integrate into SAP's offering. This is illustrated by the case of a partner company that offered an extension to SAP's on-premises ERP system that allowed for easy integrations to email software such as Microsoft Outlook. The partner migrated the solution as an application on the cloud platform, but SAP realized that this functionality could become a more integral part of the platform:

> *"So, with [our cloud application], SAP has put a spoke in our wheel because there is no partner protection. In other words, SAP bought a third-party product in the U.S. that had the same functionality. They made the product part of their sales contract... If they hadn't done that, we would be better off today with [our cloud application]."* (sales manager of an SAP partner company)

Thus, while integrating functionality into the core based on new business insights might be beneficial for SAP, it may have a negative impact on third-party developers and their commitment to the platform.

Despite SAP's governance activities intended to foster development of applications by third-party developers, the activity on the platform and its marketplace fell short of SAP's expectation. We identify two reasons why a focus on third-party developers on the platform was not sufficient to establish a scalable platform ecosystem around SAP's cloud platform:

First, applications developed by partners were primarily created for rather generic use cases that are peripheral to the customers' core business processes. For example, one of the earliest partners on the cloud platform was successful with two applications related to customer relationship management (CRM). The first application covers route planning for sales teams and the second application is a business card scanner that directly feeds the results into the ERP system. Both use cases are rather similar across companies, thus a generic application in SAP's App Center provides a useful solution for many customers:

> *"[These applications] are not rocket science. For route planning, we just combine the business system with the route planning as we did for [a German automotive*

> *manufacturer]. For our business card scanner, we improve the process by integrating the OCR[23] directly with the business process. […] applications need to be developed close to the standard process."* (sales manager at SAP partner company)

However, many use cases that are closer to the customers' core business processes, such as production, are more customer-specific than route planning or business card scanning. For these use cases, third-party applications might not offer the best fit.

The second reason why the inclusion of third-party developers on the platform failed to establish a scalable platform ecosystem around SAP's cloud platform was that these developers perceived a lack of incentive to develop applications for the marketplace because it was not yet an established sales channel, due to a lack of integration between the application marketplace as sales channel and the process by which customers buy and implement applications:

> *"Currently, the app center plays a very small role. We indeed have some software in the SAP App Center, but this is still expandable, from my point of view. Because I don't really understand how SAP sees the App Center. If I think about the Google Play Store, as customer, I can not only browse the applications, but I can directly install the software and onboard directly. […] For the SAP App Center, there is no direct integration between the App Center and onboarding. What I would expect in the long run is that customers who like an app in the App Center, for example a solution for human resources, can directly onboard after the trial period – by simply clicking 'subscribe now' all the magic happens in the background and the customer has instant access."* (technology expert for SAP solutions at a software company)

In sum, SAP realized some success with its strategy to create value with third-party developers on its cloud platform. But the number of third-party applications remained below expectations and did not spark dynamic indirect network effects, given the customer-specific requirements faced by these applications.

10.4.3 Focus on Customers as Developers (2016-2017)

Since its launch, customers have used SAP's cloud platform to develop applications for their own use. This activity was long seen as a secondary purpose of the platform while the scalable third-party marketplace was the focus. This changed with the rebranding of the platform in 2016, from HANA Cloud Platform to SAP Cloud Platform when the focus of value creation began a shift to the customer as developer. In 2018 the term 'intelligent enterprise' was established by SAP, summarizing the shift in focus that had taken place in the preceding two years. The intelligent enterprise is a vision for SAP customers to finally leverage digital transformation to become faster, smarter and more profitable – with the help of SAP's cloud platform:

> *"To unleash the full potential of an intelligent enterprise, we believe you need a strong digital platform underneath. […] It's the cloud platform that enables inte-*

[23] OCR = optical character recognition, that is, the electronic conversion of images into machine-encoded text.

> *gration and extensions of processes as well as creating new experiences and building completely new innovative additional business applications."* (Björn Goerke, CTO of SAP and President SAP Cloud Platform at TechEd 2018 in Barcelona)

Customers as developers can either develop applications themselves or work together with associated implementation partners to develop customer-specific applications. While large corporations have the means to develop applications with their internal IT department, small- and medium-sized companies often work together with implementation partners because they lack the required skills in-house. As one example, a medium-sized equipment manufacturer created a production analytics application on the cloud platform building on the company's ERP data. An implementation partner helped to develop the data integration, analytics and prediction, and the user interface. As the customer was a manufacturer of niche products, the setup of machinery and thus the data integration as well as the analytics were company-specific and could not be addressed by a generic application of a third-party developer. To support scenarios like this, SAP engaged in platform governance to support value creation with customers as developers (Table 39).

Governance activities	Manifestations	Purpose
Ensure backward compatibility	Improve backward compatibility with regard to customers' IT landscape and on-premises applications	**Core category** *Enable customers as developers*
Provide third-party service connectors	Open connectors to other cloud services so that they can be integrated in applications on the platform (e.g., Sharepoint, Dropbox, Slack)	
Support for different infrastructure providers	Support of multiple providers as underlying infrastructure for the platform (e.g., Amazon Web Services, Google Cloud Platform) and support of multiple databases (e.g., Oracle, MongoDB)	
Provide learning material	Significantly enhance learning material (e.g., LearningHub offering)	
Increase platform functionality	More platform functionality directly useful to address business problems (e.g., SAP Leonardo services)	
Claim access fees from customers and partners	Customers pay for platform access on a regular basis (subscription-based) or consumption-based, partners pay for development accounts on a regular basis	*Capture value from customers and partners*
Claim indirect access license fees	Customers pay for indirect access to the core ERP system through applications that run on the platform	
Lock in through development	Development activities of customers increase their long-term lock-in	

Table 39. SAP's Governance Approach Targeted at Customers as Developers (for illustrative quotes see Appendix F)

A main purpose of SAP's governance activities was to **enable customers as developers**. This involved ensuring backward compatibility to on-premises solutions by enabling older, ABAP solutions to run on the platform. Many of SAP's customers and partners had used ABAP to develop extensions to their on-premises ERP systems. Migrating those extensions to the cloud platform and leveraging some of the new functionality of the platform was a straightforward way for customers to have first applications running on the platform:

> *"The major use cases for SAP Cloud Platform ABAP Environment are the development of new cloud apps in ABAP, which are decoupled from the digital core. Of course, customers and partners see a chance to leverage their existing ABAP know how and want to reuse their existing on-premises assets in the SAP Cloud Platform ABAP Environment."* (SAP Blog, 2018)

In another step to enable customers as developers SAP introduced open connectors that made it possible to link applications with third-party software already being used by customers (e.g., Sharepoint, Dropbox, Slack). With these integration services, it became easier for customers to develop an application on the cloud platform that integrates with their current IT landscape.

> *"A lot of customers have come to us for SAP-to-SAP integration – typically connecting SuccessFactors with ERP. But a lot of our customers that don't have SAP wall-to-wall, use several third-party systems. So now they can use our cloud platform integration services to cover their entire landscape."* (SAP senior director in video interview at TechEd 2018)

SAP also introduced support for different cloud infrastructure providers and database technologies. For cloud infrastructure providers this included competitors such as Microsoft with its offering *Microsoft Azure* or Amazon with *Amazon Web Services*. This entailed compatibility between databases such as *Oracle DB* or *MongoDB*. Taken together, these features made the cloud platform more accessible for customers considering their current IT landscape:

> *"Now, enterprises around the globe often make strategic decisions on which hypercloud provider AWS [Amazon Web Services], [Microsoft] Azure, Google Cloud Platform they use for certain workloads […]. Many customers have actually asked us to extend their SAP Cloud Platform solutions next to those workloads in the public clouds. And we got that message and we went generally available on AWS and beta on Azure in May this year. […] Today, I am thrilled to announce SAP Cloud Platform on Google Cloud Platform as a public beta."* (Björn Goerke, CTO of SAP and President SAP Cloud Platform at TechEd 2017 in Las Vegas)

SAP significantly enhanced documentation and learning material related to creating applications on the cloud platform as part of the SAP Learning Hub to enable customers as developers. In the Learning Hub, learning material and on-site or remote classroom trainings are available for partners. SAP specifically addressed smaller customers and their partners with this offering. For example, SAP offered package deals to partner associations so that the members of the partner association would have less expensive access to the Learning Hub.

Lastly, SAP broadened the functionality offered directly by the platform. In particular, services such as analytics and machine learning were introduced under the umbrella of SAP Leonardo. These features can be directly leveraged by customers to address specific business problems with applications on the cloud platform. SAP also began to provide industry-specific blueprints on the cloud platform to further support customers in developing applications for their individual use cases. In addition, SAP encouraged partners to engage with customers and provide consultation on how to best leverage the cloud platform and Leonardo to improve their business processes:

> *"SAP's strategy has also become much broader with the [cloud] platform and of course, SAP is looking for partners who come from the business side and consult customers. So not only pure implementation partners but those who really accompany the customer very early on in this process of digital transformation. These partners then of course can refer to SAP's cloud platform along with Leonardo as the tools the customer actually needs to start the digital transformation."* (SAP alliance manager at a large IT consultancy)

SAP's governance activities related to **capturing value from customers and partners** in the case of customers as developers differ from the activities in the case of third-party developers. As customers do not directly generate revenue with the applications they create, revenue sharing is not possible. Instead, SAP first claims an access fee from customers, which is either subscription-based on a yearly basis or consumption-based depending on the services used by customers. If customers rely on partners to support them in the development of customer-specific solutions, these partners also pay an access fee for a development account on the platform. For applications that access the ERP core, customers pay additional license fees for indirect access. Most applications need access to the ERP core because it is the most valuable data source for applications. Thus, revenues from indirect access licensing have become an important pillar of the platform's overall revenue.

Fees for indirect access licenses were criticized by partners and customers because it was not always clear what costs could be expected and how they were linked to the benefit the customer gained from using the application. SAP therefore revised its policies of indirect licensing in 2017, engaged in a continuous exchange with affected customers, and once again readjusted the policies in early 2018. With the first changes, SAP no longer associated licenses for indirect access with the number of users but with the number of orders; that is, requests to the core system. In this way, the pricing was better linked to the value generated for customers. While this step was perceived as an improvement by customers, it remained difficult to predict costs for specific use cases. In a move towards a pay-per-use licensing model for indirect access, SAP further accommodated their partners' requirements. This model reduced SAP's upfront value capture but lead to a better balance with the partners' value capture:

> *"[...] we are embarking on a journey to modernize our licensing policy. Policy changes discussed herein are designed to focus on outcomes related to SAP customers' use of our software based on the value delivered. This outcome-focused approach will eliminate the need to count individual users or other parties indirectly accessing SAP ERP in certain scenarios. This approach will ensure greater pricing transparency, predictability and consistency."* (Indirect Access Whitepaper, July 2017)

When customers develop their own applications on the platform, they increase the lock-in on the platform. Given the increasing competition by other cloud platforms such as Microsoft Azure or Amazon Web Services, this lock-in is valuable and represents potential for future monetization. This lock-in effect on the level of business applications is gaining importance because underlying infrastructure (such as cloud infrastructure providers and databases) are increasingly cross-compatible making lock-in difficult on the infrastructure level.

In sum, the platform became a valuable tool for customers to develop solutions for their own use. Customers were now able to develop applications for use cases that were either very specific thereby eliminating generic third-party application or so close to the customer's mission critical processes that the company would turn to a third-party solution.

10.4.4 Second Approach to Third-Party Developer Platform Ecosystem (2017-2018)

With the focus on customers as developers, SAP's cloud platform gained track and had more than 10,000 corporate customers in late 2018 including many large corporations. The increasing installed base of customers led SAP to again enhance its governance approach: To establish a platform ecosystem of third-party developers, SAP aimed at **increasing scalability of solutions across customers** (Table 40).

Governance activities	Manifestations	Purpose
Facilitate reusability of modules	Micro services architecture helps partners and third-party developers to reuse components of applications	*Increase scalability across customers*
Connect customers and partners	Help customers to find existing modules or solutions that address their specific needs	

Table 40. SAP's Governance Approach, again Targeted at Third-Party Developers (for illustrative quotes see Appendix F)

The redesign of boundary resources compared to the on-premises age makes it easier for customers and partners to reuse parts of projects and applications. Although applications are developed for a specific use case, modules can be reused for other use cases. Associated implementation partners can even reuse these modules across customer-specific projects as long as the intellectual property (IP) is maintained. For example, the cloud platform allows developers to create micro-services which are then combined in a business application. The micro-services might then be reusable in other projects. As one interview partner illustrates:

> *"We evaluate the reuse potential of customer projects. 99% of our projects are customer-specific. But if we identify reuse potential, we develop the solution in a modular way, keep the IP, and reuse the modules. Internally, we have more than 200 modules that we can reuse."* (Global managing director of an IT consulting company)

On a higher level, partners can reuse knowledge about a specific use case rather than the code itself. Partners not only gain experience in the process of developing applications on the cloud platform but they also identify promising use cases for applications they can leverage in follow up projects with other customers:

> *"You just look at the use cases of these individual implementations that were made for the customers but you don't use the code because otherwise IP becomes an issue. That said, we take the use case as a template or we might take the general architectural approach as a template, but the implementation is then really a new development with the aim of making this a product. […]. The real effort is usually not to write the code but to have the use case and to understand the UI flow and how this should work. The code is then relatively easy."* (Managing director at large IT consulting company)

SAP helps customers to find partners that have worked on solutions that address their specific needs or at least similar needs. Although the cloud platform's marketplace does not include applications for rather specific use cases, there is an increasing number of partners trying to scale from purely customer-specific projects to at least partly reusable components of software as a service solution. To improve matchmaking, SAP hosts large events such as SAPPHIRE NOW[24] at which SAP showcases *"end-to-end solutions that meet […] business challenges and empower you to leave [SAPPHIRE NOW] with solutions"* (SAP SE 2018d). These showcases often involve partners, which allows customers to identify possible collaborators for their own solutions. Furthermore, in particular for larger customers, SAP typically consults customers and directly refers them to partners that can help to address their use cases.

In sum, the renewed platform governance approach of SAP enhanced the customer as developer ecosystem to a multi-faceted platform ecosystem where partners and third-party developers offer solutions to customers through different channels while trying to maximize reusability.

10.5 Interpretation and Discussion

With our results on SAP's cloud platform we challenge the assumption that a scalable ecosystem of third-party developers is the key for the success of cloud platforms in the enterprise software industry. Instead, platform owners need to acknowledge the role of customers as developers when transforming product platforms to platform ecosystems before aiming at scalability.

10.5.1 From Product Platform to Platform Ecosystem

Abstracting from the case of SAP, we propose a process model that describes how product platforms in the enterprise software industry transition to platform ecosystems. We use a process lens to better understand how platform ecosystems and their owners' governance continually evolve (Langley et al. 2013; Langley/Tsoukas 2010). We acknowledge the role of context as a source of both constraints and opportunities (Mowday/Sutton 1993; Johns 2006). The enterprise software context differs from contexts in business-to-consumer software markets where most research on platform ecosystems has been conducted.

The process model shows that platform owners need to first create an ecosystem of customers as developers to accommodate the customer-specificity of many use cases in the ecosystems. With an increasing customer base, platform owners can direct the ecosystem towards a two-sided platform ecosystem by increasing scalability of applications across use cases (Figure 31).

[24] SAPPHIRE NOW is SAP's largest user and partner conference. It takes place annually and showcases the latest technologies of SAP.

A direct transition from a product platform to a platform ecosystem fueled by third-party developers is hardly feasible, as illustrated by SAP's first approach to establish a platform ecosystem.

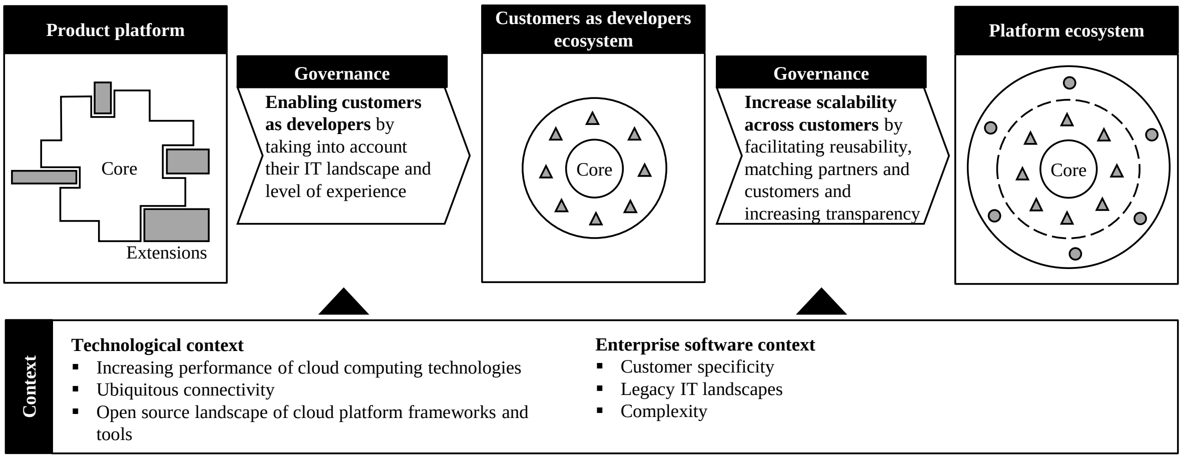


Figure 31. Governing the Process from Product Platform to Platform Ecosystem

While technological context factors create the opportunity for a transition to platform ecosystems in the first place, factors specific to the enterprise software context create constraints that have an impact on platform governance.

Technological context factors include the increasing performance of cloud computing technologies, ubiquitous connectivity, and a growing open source landscape of cloud platform frameworks and tools. These factors create opportunities for software as a service offering in the enterprise software industry. For example, large amounts of data can easily be uploaded and analyzed with little delay. With a platform layer that abstracts the enterprise software core from applications in the cloud, third parties can create applications that use data from the enterprise software core regardless if the core is also hosted in the cloud or is still deployed on premises. The increasing availability of open source tools facilitates onboarding for third-party developers as they benefit from the accumulated knowledge of the community. In sum, technological context factors create the opportunity for enterprise software vendors to transform a product platform into a platform ecosystem.

But factors specific to the enterprise software context constrain this transition. For example, the requirements that customers have for their ERP are heterogeneous and are customer-specific given different company sizes, industries, or locations (e.g., Ceccagnoli et al. 2012). Applications that address specific requirements of a customer are often not generalizable across customers and it would not be beneficial for third-party developers to market them. The applications used on the platform need to integrate with the customers' legacy IT landscapes. Thus, much of the development that customers do on the cloud platform actually is related to integrating the cloud applications within the IT landscape. This application is typically a customer-specific activity that is difficult for third-party developers to offer. In the context of enterprise software, it is next to impossible to reduce complexity towards developers in a way that it is done in the case of mobile phones or gaming devices. For these platforms, complexity is encapsulated in the devices and the operating system, third-party developers only need to understand the APIs offered to interact with the operating system. In the context of enterprise software, the customer's business processes, for example its manufacturing process and the machine outfit, creates complexity for third-party developers because they need to understand the customer's setup to create useful applications.

Based on the context factors, we describe the transition from product platform to platform ecosystem in the enterprise software industry in two phases. The first phase, which we label cloud abstraction, includes the introduction of a cloud platform as abstraction layer between enterprise software core and the periphery of applications. Platform owners should focus governance on the customer as developer, acknowledging the constraints of the enterprise software context. Most customers that use the cloud platform act as developers and create applications for their own use, often together with associated implementation partners. These applications are either crucial for the company's business process, so that the company does not want to use third-party solutions, or the applications address niche use cases for which third-party solutions are not available. The result is an ecosystem with increasing activities of customers as developers, often together with associated implementation partners.

In a second phase, platform owners should increase scalability of applications across customers. As customers implement specific use cases, there are still parts of the implementation that could be reused by others. By using standards and open source technologies on the level of micro services, platform owners can make it easier to reuse components and modules of solutions that have been developed by others. This also allow partners involved in customer-specific implementation projects to modularize these projects and reuse modules in other implementation projects. Furthermore, platform owners can engage in active matchmaking to bring customers and partners or third-party developers together. Platform owners can increase transparency in the ecosystem to enable customers to find suitable partners on their own by, for example, not only having a marketplace for solutions but also a marketplace or catalogue for components such as micro services that can be used to create solutions.

As a result of these transition phases a multifaceted platform ecosystem emerges that includes various constellations of value co-creation in which customers, implementation partners, and third-party developers are involved. The process model shows how to get there and thus contributes to literature on digital platforms in several ways. First, the model explicitly takes the evolving nature of platform ecosystems into account by considering the role of time. Platform ecosystems – no matter in what context – are highly dynamic and evolve over time (De Reuver et al. 2018; Hanseth/Lyytinen 2010). We captured these dynamics with a processual approach and thereby identified specific phases of platform ecosystem evolution and suitable platform governance approaches. Second, our study considers platform ecosystems in the complex enterprise software context. We highlight that not all platform ecosystems can be interpreted as simple two-sided markets, a model predominant in IS research (Tiwana 2014; Constantinides et al. 2018). To understand platform ecosystems in complex environments such as ERP or the Internet of Things, we need to account for heterogeneity in how value is co-created in the ecosystem, for example by considering customers as developers. This contribution also adds to literature on enterprise software because we show the transition from packaged software to platform ecosystems fueled by cloud computing technologies, which has implications for research areas such as adoption, implementation, and usage of enterprise software in organizations (Esteves/Bohórquez 2007; Esteves/Pastor 2001; Eden et al. 2014).

10.5.2 Governing Customers as Developers

By outlining the transition process of product platforms to platform ecosystems in the enterprise software industry, we found that the resulting platform ecosystem differs from the general view on platform ecosystems in literature. One striking difference relates to who is involved in value co-creation: According to the general view on platform ecosystem, the platform core is extended by third-party developers who offer their applications on a two-sided marketplace (Tiwana 2014). In the enterprise software platform ecosystem, amongst others, many customers create solutions for their own use. Governing these customers as developers differs from governing third-party developers.

While other actors including implementation partners, consultants, and third-party developers are involved in value co-creation in enterprise software platform ecosystems, customers as developers are prerequisite to "unlocking" the larger platform ecosystem. We thus summarize our findings on governing customers as developers in comparison to governing third-party developers as discussed in literature on general platform ecosystems (Table 41).

		Third-party developers	**Customers as developers**
Focus of platform governance		Balancing openness and control to reach critical mass	Enabling customers to act as developers in order to increase the installed base
Network effects		Strong indirect network effects	Direct network effects
Value co-creation	*Openness & control*	▪ Openness with focus on minimal entry barriers for third-party developers ▪ Control of quality of the third-party applications	▪ Openness with focus on compatibility to customers' existing IT landscape ▪ No balance of openness with control required, but protection of platform core to ensure stability
	Provision of boundary resources	▪ Standardized boundary resources that allow for generativity and control	▪ Standardized boundary resources ▪ Boundary resources that take into account individual requirements and levels of experience of customers
Value capture	*Pricing/revenue sharing*	▪ Platform owner claims a share of the revneue generated by third-party developers	▪ Customers and implementation partners pay for the platform ▪ Pricing linked to the benefit customers gain from the platform
	Absorption	▪ Including functionality into the platform core – can be harmful for value co-creation	▪ Including functionality into the platform core – not harmful for value co-creation
	Lock-in	▪ Lock-in effect if third-party developers do not multihome	▪ Strong lock-in effect because customers build applications on the platform

Table 41. Comparison of Platform Governance for Third-Party Developers and Customers as Developers

Literature has considered platform ecosystems as two-sided, with third-party developers on the one side and customers on the other. In these two-sided platform ecosystems, platform governance focusses on third-party developers. Platform governance activities aim at balancing openness and control to reach critical mass and to maximize value co-creation (Constantinides et al. 2018; Tiwana 2014). Customers are attracted by the applications and trigger indirect network effects that can lead to exponential growth of the platform ecosystem (Evans/Schmalensee 2010).

When the focus of platform governance shifts to the customer as developer, the main goal is to enable customers to create value for their business to increase the installed base of customers. Customers are not attracted by third-party applications but by the core features of the platform and the possibility to adapt these to their own needs. Thus, direct network effects gain importance within an increasing community of customers as developers where best practices are shared (Eisenmann et al. 2006; Katz/Shapiro 1986). Indirect network effects again come into play when implementation partners and consultants engage with customers as developers.

Looking at **value co-creation**, platform owners of a two-sided platform ecosystem strive to engage with the largest number of third-party developers possible in order to increase the number of applications on the platform through platform openness (Tiwana et al. 2010; Tiwana 2014; Ondrus et al. 2015). Simultaneously, platform owners want to ensure the quality of the applications available on the platform: poor quality could harm the image of the platform ecosystem as a whole (Cenamor et al. 2013; Schilling 2009). To achieve these goals of value co-creation, platform owners balance openness and control (Manner et al. 2013a). They make the ecosystem accessible for third-party developers, provide them with standardized resources – boundary resources – that support them in developing applications, and they set up formal control mechanisms (Ghazawneh/Henfridsson 2013).

When customers as developers come into play, the balance of openness and control is less relevant. Openness remains equally important but changes but its characteristics change: instead of just reducing entry barriers for third-party developers, platform owners need to be open to customers with their specific IT landscape. Compatibility to the technologies such as databases, programming languages, and frameworks used by customers is crucial along with connectivity to third-party services and support for different infrastructure providers. This openness does not need to be balanced with input or output control mechanisms. Customers as developers do not market the applications they develop; if applications are faulty only their company is affected. But, the platform owner needs to ensure that the applications do not negatively affect the core ERP system. This is done through a clear technological separation of the core ERP system and the platform through interfaces. In addition to standardized boundary resources, platform owners need to offer boundary resources such as documentation, learning material, trainings, and support that addresses individual requirements and different levels of expertise on the customer side. As further boundary resources, platform owners can support increased scalability of application across customers by facilitating reusability of modules and connecting customers and partners. These activities further strengthen direct network effects among customers and their implementation partners.

For **value capture**, literature suggest that in two-sided platform ecosystems the platform owner claims a share of the revenue generated by third-party developers (Hagiu, 2006; Lin, Li, & Whinston, 2011; Oh, Koh, & Raghunathan, 2015). Although other pricing mechanisms such as an access fee to the platform for third-party developers have been discussed in literature, revenue sharing is the most dominant form of value capture. In addition, platform owners can indirectly capture value through absorption, that is, by including the functionality of successful third-party application in the core of the platform (Saarikko 2016). Because absorption can decrease the incentives for third-party developers to join the ecosystem as they fear imitation in the case of success, it should be applied with caution (Schreieck et al. 2017c). Lastly, platform owners can indirectly capture value through a lock-in effect of customers when they use third-party applications. But this lock-in result only takes effect if third-party developers do not multihome, that is, if they do not offer their applications on competing platforms as well (Cennamo et al. 2018; Koh/Fichman 2012).

In the case of customer as developer ecosystems, value capture becomes more difficult because customers as developers do not directly generate revenue with the applications they build. Instead, platform owners charge customers and their implementation partners for using the platform and pricing should be linked to the benefits customers gain from using the platform. Because pricing is difficult to regulate, platform owners use proxies. For example, SAP claims additional licensing costs if applications on the cloud platform trigger transactions in the ERP systems because this is an indicator that business was generated. Platform owners can rely on absorption for long-term benefits from the ecosystem. By observing the activities in the ecosystem, platform owners can identify successful applications whose functionality can be included in the platform core. Absorption is less problematic because the customers were not planning on marketing the applications. Furthermore, the platform owner benefits from the increased lock-in of customers on the platform (cf. Parker/Van Alstyne 2005). If the customer has developed their own applications, switching costs to different platforms may increase because the customer would need to migrate the applications.

With our work on governance for customers as developers in platform ecosystems, we contribute to what is known about customers simultaneously acting as producers, becoming 'prosumers' on digital platforms (e.g., Bosch 2009; Veit et al. 2014; Schlagwein/Bjørn-Andersen 2014). Going beyond literature on software platforms, customers have been shown to co-create value in new product development by: (1) providing ideas for products and services; (2) participating in design and implementation; (3) testing and taking on support tasks (Nambisan 2002; Hippel/Katz 2002; Whelan et al. 2014). IT and IT-enabled capabilities thereby play a major role in the success of customer involvement (Piller/Walcher 2006; Saldanha et al. 2017; Nambisan 2013).

In platform ecosystems, the source of innovation and value co-creation will thus become increasingly blurred as customers, implementation partners, and third-party developers create solutions in different constellations. By understanding the role of customers as developers, we provide a first step to understanding the dynamics in such ecosystems.

10.5.3 Limitations and Future Research

A limitation immanent to grounded theory single case studies (cf. Corley/Gioia 2004) relates to the generalizability of the findings. We suggest that our findings on platform governance apply to platform ecosystems that emerge from complex technologies where the environment inhibits reduction of this complexity. We see numerous platforms emerging in the industrial Internet of Things and in the context of machine learning and artificial intelligence in both consumer- and business-focused markets. Based on our results, we propose that in these contexts, no large-scaling platform ecosystems with thousands of third-party applications will emerge to dominate the market. Rather, those platform owners that best understand customers and enable them to use the technology for their own business applications will be successful – and there might be room for many of these platforms. Indirect network effects that would tend to create dominating platforms will only play a limited role as the customers' needs are too specific.

Future research could not only look at other platform ecosystems that emerge in complex environments, but also identify patterns for the success of such platform ecosystems, for example by conducting multi-case studies or qualitative comparative analysis (e.g., El Sawy et al. 2010). Furthermore, studies that compare platforms focusing on third-party developers and those focusing on customers as developers could shed further light on the circumstances favorable for one or the other strategy. It would also be worthwhile to analyze activities of large-scale business-to-consumer platforms such as Apple's iOS and how they address contexts in which complexity emerges – for example, when businesses use iOS to develop internal applications or when consumers need to engage in development when connecting different devices and services in the context of smart homes.

We anticipate our findings on the emergence of platform ecosystems and related approaches to platform governance will spark further research and assist companies to establish successful platform ecosystems in different industries.

11 How Traditional Companies Establish Platform Ecosystems through Multi-Layer Governance – A Cross-Industry Study (P8)

Title	How Traditional Companies Establish Platform Ecosystems through Multi-Layer Governance – A Cross-Industry Study[†]
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Publication	European Journal of Information Systems (EJIS)
Status	Under review, second round
Contribution of first author	Problem definition, research design, data analysis, interpretation, reporting

Table 42. Fact Sheet Publication P8

[†] This publication is based on an earlier conference paper (Schreieck et al. 2018).

Abstract

Establishing platform ecosystems is a huge challenge for traditional companies. They face a high degree of internal and external complexity such as heterogeneous product portfolios, fragmented markets, and existing partner networks. This complexity needs to be considered in the platform governance approach. IS research does not yet capture the complexity traditional companies face when creating platform ecosystems. Studies on platform governance mostly focus on "digital-native" companies that establish platforms on the green field. These results are of limited help for traditional companies that struggle to transform their existing business to a platform ecosystem. To address this gap, we conduct a multiple case study based on five traditional companies from different industries. We show that these companies apply governance on multiple ecosystem layers to manage the collaboration among (1) internal business units, (2) core partners, and (3) peripheral partners. Thereby, internal and external complexity affects the way companies govern these three stakeholder groups. Our work enhances literature on platform governance by detailing the established core-periphery model of platform ecosystems for the context of traditional companies and proposing complexity as antecedent for platform governance.

11.1 Introduction

In recent years, we observe an increasing number of traditional companies from different industries shifting to a platform strategy (Sebastian et al. 2017). Car manufacturers such as BMW with its platform "BMW Connected", equipment manufacturers such as Trumpf with its platform "Axoom", or banks such as Singapore's OCBC Bank with its Connect2OCBC platform create digital platforms to generate innovation and to keep up with the breakneck speed of the digital transformation. These companies strive to create a platform ecosystem with a digital platform at the core and third-party developers that engage in value co-creation at the periphery (Kuk and Janssen, 2013; Zittrain, 2006). However, recent reports show that traditional companies struggle to successfully establish platform ecosystems (Sebastian et al. 2017; Hagiu/Altman 2017).

Platform governance is one of the keys to success of a platform ecosystem (Tiwana et al. 2010). Platform governance refers to the platform owner's activities to manage the relationships with third-party developers, for example granting autonomy, implementing control mechanisms or providing resources (Tiwana 2014; Ghazawneh/Henfridsson 2010). The right governance approach incentivizes third-party developers to contribute to a platform ecosystem by aligning their incentives with the goals of the platform owner (Boudreau 2010).

For traditional companies, platform governance goes beyond governance of third-party developers as traditional companies face a complex environment when implementing platform ecosystems: First, traditional companies such as automotive manufacturers, banks, or long-established software firms have developed complex internal structures often dominated by a number of different strategic business units (Reynolds/Yetton 2015; Lu/Ramamurthy 2011). Second, traditional companies have complex networks of core partners with whom they collaborate to develop, build and market products or services (Das/Teng 2000; Tanriverdi et al. 2010). When setting up a platform ecosystem, traditional companies need to consider this internal and external complexity.

Literature on platform governance rarely considers the challenge of governing different internal and external stakeholders that traditional companies face in platform ecosystems. Researchers have mostly focused on platform ecosystems that have been built on green fields such as Google's Android platform (e.g., Tilson et al. 2012a; Oh et al. 2015) or Facebook's platform for games (e.g., Hilkert et al. 2010; Claussen et al. 2013). Our theoretical understanding of platform governance is based on a core-periphery model that captures the relationship between the platform owner and third-party developers (Wareham et al. 2015; Gawer 2014). The platform core is seen as a black box controlled by the platform owner (Tiwana 2014) and it remains unclear how the additional complexity that traditional companies face impacts the core-periphery model and platform governance.

To contribute to this gap, we pose the research question *'How do traditional companies govern the core and periphery of their platform ecosystems?'* Addressing this question, we conduct an exploratory multiple case study on five traditional companies from different industries that introduce platform ecosystems and that face differing degrees of internal and external complexity.

Our results show that traditional companies apply multi-layer governance approaches to manage collaboration among (1) internal business units, (2) core partners, and (3) peripheral partners. We provide details on the mechanisms that these governance activities comprise, contributing to literature on platform governance. We then reflect how different degrees of both internal and external complexity of platform ecosystems affect governance activities. Extending the core-periphery model of platform ecosystems, we show that governing the core of a platform (i.e., internal business units and core partners) is crucial for the success of platform ecosystems of traditional companies. This work helps traditional companies to avoid common mistakes in creating platform ecosystems and to consciously apply platform governance instead of relying on trial-and-error strategies.

11.2 Theoretical Background

As recommended for exploratory case studies, we develop a theoretical pre-understanding of the phenomenon under study (Walsham 1995). To do so, we first review literature on digital platforms and platform ecosystems. Then, we link literature on IT governance and platform governance to illustrate that our pre-understanding on platform governance is not sufficient for the challenging situation that traditional companies face.

11.2.1 Digital Platforms and Complexity in Platform Ecosystems

We define digital platforms as "the extensible codebase of a software-based system that provides core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate" (Tiwana et al. 2010, 676). Due to their extensible nature, digital platforms enable the platform owner to "unlock" the potential of a broader platform ecosystem of third-party developers for value co-creation (Kuk/Janssen 2013; Ondrus et al. 2015; Zittrain 2006). Thereby, digital platforms facilitate a multisided business model that brings together third-party developers on the one side and customers on the other side. Taken together, we refer to the digital platform, its interfaces and complementary applications, and the platform's stakeholder as platform ecosystem.

Platform ecosystems are complex systems following the interpretation of complexity as the number of components, their interactions and their dynamic changes over time (Schneberger/McLean 2003; Hanseth et al. 2006). We thereby interpret components not only as software components but also as actors in the ecosystem. While platforms help to cope with complexity (Dibia/Wagner 2015), different degrees of internal and external complexity affect how a platform can be successfully implemented and governed.

We refer to **internal complexity** as the complexity of the products and services underlying the platform. Digital platforms introduce a horizontal structure on which complementary applications can be created in a modular way (Tiwana 2014). The communication between applications and platform is channelled through standardized application programming interfaces (APIs) (Evans/Basole 2016). The modularity that the platform structure induces is thereby key to reducing internal complexity (Baldwin/Clark 2000; Pil/Cohen 2006). For example, the success of Apple's iPhone is based on the flourishing ecosystem of third-party applications. This ecosystem is only possible because Apple made it simple to develop applications for a complex device with a complex operating system (Gawer/Cusumano 2014).

External complexity refers to the complexity a company faces outside its boundaries such as the complexity of the markets it addresses or the complexity of its partner network. As digital platforms commonly bring together two sides of a market – third-party developers and customers – the complexity in the market can be accommodated better. On marketplaces of digital platforms, it becomes easier for third-party developers to get access to their target group, even if it is small and distributed across the world. On the other hand, customers can easily identify suitable solutions for their own needs (Rossignoli et al. 2009) because online marketplaces are easily searchable. For example, third-party developers offer specialized solutions for different industries on the Salesforce platform, benefiting from the global reach of the marketplace (Baek et al. 2014).

With a rising internal and external complexity that underlies digital platforms, setting up and governing the emerging platform ecosystems becomes more complex as well (Tilson et al. 2012b). Literature on digital platforms and platform ecosystems tends to remove platform complexity by using abstract models to represent them (Tilson et al. 2013) such as the core-periphery model (Wareham et al. 2015; Gawer 2014). Traditional companies that implement digital platforms tend to face large internal and external complexity as they usually have products, organizational structures, partner networks and market relationships that have grown over time. It would be thus worthwhile to analyse the complexity they face and to differentiate according to varying degrees of internal and external complexity. The varying complexity has an impact on how the platforms can be governed successfully (Basole/Rouse 2008).

11.2.2 Governance in the Context of Platform Ecosystems

Organizational governance and IT are deeply intertwined as IT enables new ways to conduct organizational governance while the development and usage of IT in organizations has to be governed as well (Tiwana/Kim 2015). This notion is often referred to as IT governance, comprising governance arrangements such as innovation networks, platform ecosystems, or open source communities. Thereby, IT governance describes what is governed, who is governed and how it is governed (Tiwana et al. 2013).

Platform governance can be interpreted as a specific type of IT governance. Building on the dimensions of IT governance by Tiwana et al. (2013), the digital platform as artefact and third-party applications as content can be referred to as **what** is governed. For example, the degree of standardization that the platform entails and the way its interfaces are designed are an important decision in platform governance (Wareham et al. 2015). Decision rights, control, and the provision of boundary resources are aspects of **how** the platform is governed. A higher degree of openness to attract third-party developers entails that platform owners have to give up a part of their decision rights (Eisenmann et al. 2009; Ondrus et al. 2015). Formal and informal control mechanisms have been shown to be effective in governing the quality of third-party applications on platforms (Goldbach/Benlian 2014; Goldbach/Kemper 2014) and the design of boundary resources has been identified as key to support third-party developers in the process of creating applications (Eaton et al. 2015; Ghazawneh/Henfridsson 2013).

The question of **who** is governed in the case of platform governance is answered in literature in a straightforward way: the platform owner governs the third-party developers (Tiwana 2014;

Ghazawneh/Henfridsson 2013). For example, Apple as the platform owner of the iOS platform provides boundary resources, applies control mechanisms and decides on the degree of autonomy of third-party developers (e.g., Eaton et al. 2015; Goldbach/Benlian 2014). The platform owners thereby stay in exclusive control of the platform's core while opening the periphery of the platform to externals (Parker et al. 2016; Baldwin/Woodard 2009). Governing the core and periphery of a digital platform entails questions such as where to draw the line between core and periphery and to what degree to standardize the interfaces between the two (Wareham et al. 2015). We summarize our theoretical pre-understanding of platform governance in Figure 32.

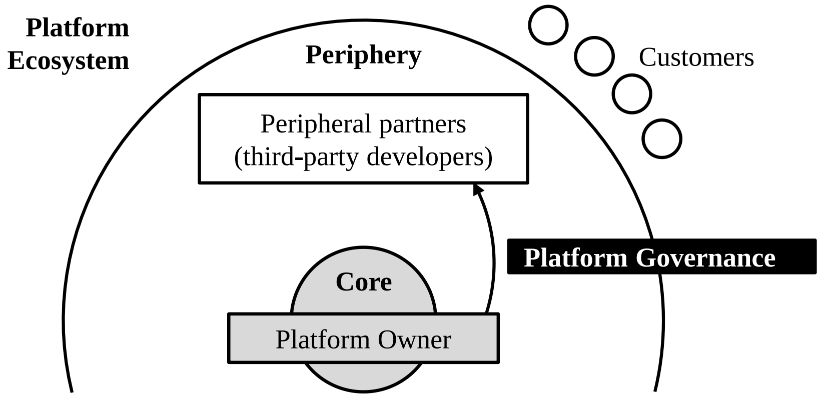

Figure 32. Theoretical Pre-Understanding of Platform Governance (cf. Tiwana 2014; Tiwana et al. 2010)

The theoretical pre-understanding shows that platform governance has up to now focused on the relationship between the platform owner and third-party developers, thus the interaction between the core and the periphery. Actors within the core are not considered.

Reflecting the situation of traditional companies that implement platform ecosystems suggests that the platform core is developed and managed by a network of internal business units and existing partners of a traditional company. Having grown over years or even decades, traditional companies have developed a complex internal structure along with mechanisms to govern that structure. For example, companies often have created strategic business units that address specific markets and are granted some autonomy from the corporate centre (Reynolds/Yetton 2015). In literature on network governance, it has emerged that dual network structures with a core network of strong ties and a peripheral network of weak ties enhances a company's relational capabilities and thus its innovativeness (Capaldo 2007). Hybrid governance forms that comprise both hierarchical approaches to govern strong ties and market approaches to govern weak ties need to be applied (Koch/Schultze 2011; Reuer/Devarakonda 2016; Li et al. 2008). For example, partnerships, franchises, joint ventures, consortia, but also platform ecosystems have emerged as hybrid governance approaches (Reuer/Devarakonda 2016; Makadok/Coff 2009; Meer-Kooistra/Vosselman 2006).

Linking literature on platform governance with that broader view on IT governance shows the need to better understand the core of the platform ecosystems that traditional companies aim to create. Governance approaches that consider actors both in the core and in the periphery of the platform are required, thus we need to shed light on the black box of the platform core.

11.3 Method

To close the theory gap related to the governance of platform ecosystems initiated by traditional companies, we conduct an exploratory multiple case study with five companies that have shifted to a platform strategy.

11.3.1 Exploratory Multiple Case Study

Taking on an interpretivist stance (Goldkuhl 2012), we conduct an exploratory multiple case study following a grounded theory approach which is appropriate for several reasons. First, traditional companies that shift towards a platform strategy are a complex and dynamically evolving subject. It is thus advisable to study this phenomenon in its context with an iterative interplay of data collection and analysis. Second, the theory gap we identified is worthwhile to be researched with an explorative, inductive approach. Due to the heterogeneous and young field of platform theories, developing a theoretical framework and related hypotheses upfront is hardly feasible (Urquhart et al. 2010).

Our multiple case study comprises *IS-Corp* (all companies anonymizes), an enterprise software vendor, *API-Bank*, a financial services company, *Car-Tec*, an automotive manufacturer, *Tool-Group*, a producer of tools and equipment, and *ES-Comp*, a provider of cloud services (**Fehler! Verweisquelle konnte nicht gefunden werden.**).

Company	Description	Platform strategy
IS-Corp	▪ Multinational software company focusing on enterprise software such as enterprise resource planning (ERP) software ▪ Partnering with various software companies, IT providers, and IT consultancies to offer end-to-end solutions	▪ Cloud platform layer on top of ERP software to collaborate with third-party developers and to leverage innovative ideas form outside of the company ▪ Competition with cloud-based platform businesses such as Salesforce
API-Bank	▪ Global banking and financial services company ▪ Increasing focus on digital offerings to provide a seamless customer experience via multiple channels mainly for individual and business customers	▪ Platform strategy as response to fintechs, tech start-ups attacking the key business of traditional banking companies ▪ The platform makes some of the bank's data and functionalities accessible to third-party developers via APIs
Tool-Group	▪ Multinational company that manufactures tools and equipment for construction and building maintenance ▪ In recent years, the group started to offer digital solutions that enhance their products and tools were equipped with computing hardware and connectivity	▪ With the digital platform, tools are now connected to the internet so that cloud-based applications can leverage the connection to a whole portfolio of tools ▪ In the future, platform will be opened to third-party tools
Car-Tec	▪ European automotive manufacturer with a global production and sales network ▪ Shift from a pure automotive manufacturer to a provider of individual mobility (e.g., involvement in car sharing and fleet management)	▪ Digital platform to enhance *Car-Tec*'s infotainment system with third-party services ▪ *Car-Tec* modularized its monolithic onboard software to enable a platform architecture
ES-Comp	▪ Multination provider of cloud services, enterprise software solutions and IT consulting ▪ Gradual expansion of cloud offering from hosting to components and applications	▪ Establishment of a scalable cloud architecture through acquisitions and contributions to open source cloud platform framework ▪ Foundation of an ecosystem of cloud services and applications

Table 43. Description of Case Companies and Their Platform Strategies

According to the grounded theory approach, we did not sample the cases upfront based on fixed sampling criteria. Instead, we started with one case and sampled further cases with characteristics that contribute to the theoretical satisfaction of our results (Urquhart 2013). Two basic sampling criteria applied for all cases: the companies had to be established and successful in their industries since before the dotcom bubble and they had to be in the process of implementing a digital platform strategy. We then selected our case companies based on differing degrees of internal and external complexity that the companies seek to address with the platform.

We started with the company *IS-Corp* that had launched their cloud-based enterprise software platform several years ago. *IS-Corp* faced high external complexity as it traditionally collaborates with a network of heterogeneous partners and addresses fragmented, global markets. Internal complexity is moderate as *IS-Corp* already had modularized its core enterprise software to collaborate efficiently with partners that add extensions to the software. We enhanced that case with insights from *ES-Comp* that exhibits similar internal and external complexity. We then sampled cases from B2C markets that typically are of a less complex structure than B2B markets. These cases comprised *API-Bank* and *Car-Tec* whereas *Car-Tec* had a greater internal complexity due to the car's complex on-board systems that had to be prepared for the launch of a digital platform. *API-Bank* limited its platform to relatively simple B2C services, thus facing less internal complexity. To include cases with both high internal and external complexity, we chose *Tool-Group*. In that case, internal complexity is high due to a high number of diverse tools and related services that should be part of the platform. External complexity is high because the market for tools is fragmented and a large network of small partners is conducting sales and support activities. Our sampling of the cases is summarized in Figure 33.

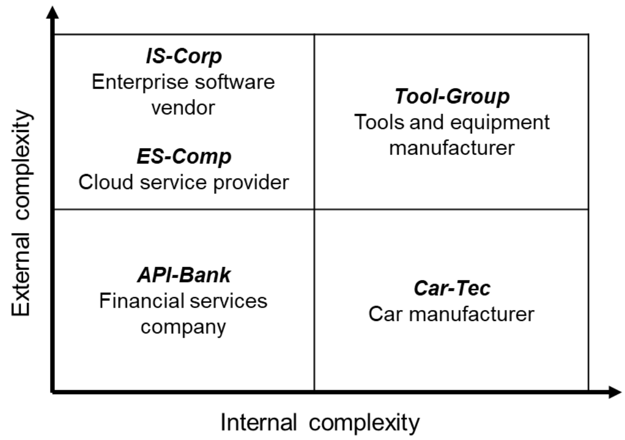

Figure 33. Sampling of Cases

11.3.2 Data and Analysis

To analyse the cases, we iteratively collected primary and secondary data from the five companies and followed procedures of the grounded theory methodology to analyse them (Wiesche et al. 2017). For gathering primary data, we conducted semi-structured interviews with employees involved in the platform projects. In addition, we evaluated available documentation as secondary data. In sum, we conducted 70 interviews across all cases from February 2016 to October 2017 (Table 44). Of the 70 interviews, 68 were recorded and transcribed, while for two interviews we had to rely on memos due to confidentiality reasons.

	IS-Corp	*API-Bank*	*Tool-Group*	*Car-Tec*	*ES-Comp*	
Platform owner						
Strategy	5	2	3	3	1	
Technology	5	4	6	5	3	
Partner mgmt.	7	1	1	2	-	
Sales	3	1	1	1	1	
Partners	8	3	-	3	1	
Total	**28**	**11**	**11**	**14**	**6**	**∑ 70**
Average duration	58 min	52 min	45 min	55 min	55 min	

Table 44. Number of Interviews per Case

For the coding process, we applied procedures of the grounded theory methodology including open, axial, and selective coding (Glaser/Strauss 1998; Urquhart 2013; Strauss/Corbin 1990). We started with open coding and created 980 codes associated with 1,629 interview quotes. In axial coding, we identified sub-categories that summarized open codes related to the governance of different stakeholders of the platform ecosystems or to the internal and external complexity related to the digital platform. We clustered these sub-categories to categories that describe different aspects of governance. Subsequently, we conducted selective coding to relate the categories to specific aspects of governance, to varying complexity, and to our theoretical pre-understanding. The coding scheme is illustrated in Table 64 in Appendix G. Following the principle of constant comparison (Urquhart et al. 2010), we returned to the data whenever a relationship emerged in the selective coding to verify its grounding in the data.

11.4 Results and Interpretation

In this section, we describe how the companies apply governance across different layers of the platform ecosystem to manage collaboration among (1) internal strategic business units, (2) core partners, and (3) peripheral partners.

11.4.1 Governance of Internal Business Units

All five case companies had realized the potential of digital platforms to leverage a broader ecosystem of third-party developers for value co-creation. But implementing the platform successfully entailed significant challenges for the companies because their businesses formerly were all based on non-platform strategies. The first challenge is to identify the basis for a platform and potential first use cases. Our cases show that the ideas where to start with a platform often emerged bottom-up from different projects or business units. For example, in the case of *ES-Comp*, the increasing capability of its cognitive software enabled various use cases across heterogeneous domains such as healthcare or automotive. The business unit behind the software realized that, even with partners, they could not build up the knowledge and skills for every use case:

> *"In healthcare, we've became active ourselves, we have hired health professionals to understand how they work with our cognitive software, we have partnerships with prestigious medical schools or cancer research centres in New York, for example, to have access to the domain knowledge of course. But we also noted, that it makes no sense, if [ES-Comp] engages in all topics."* (Architect, ES-Comp)

Thus, the idea to implement a platform ecosystem emerged from one specific business unit. Granting the business units the degree of freedom to come up with platform projects and implement first use cases was a pre-requisite for platform ecosystems to emerge within the traditional companies.

Once promising platform ecosystems emerged, we noticed stricter governance approaches to align different business units on the platform. Traditionally, different business units are responsible for different products and services. For example, in the case of *Tool-Group*, different business units develop, build, and market different product lines of tools. A digital platform that offers additional services for the customers will only create value if the heterogeneous tools from different product lines can be integrated in one platform. The manager of a construction company that is a customer of *Tool-Group* needs information on all of the company's tools, no matter whether the tool is part of a product line of drilling machines or of cutting machines. The product owner of *Tool-Group's* digital platform summarizes this challenge:

> *"[Establishing a platform] requires multiple silos to suddenly work together […] one tool that is connected is a nice thing, but most of the use cases which really differentiate your offering requires a population [of tools] that is really connected. And getting that population equipped, considering hardware development cycles, product life cycles, adoption rate at customers, willingness to pay for it, hardware cost for connectivity, technology readiness, communication technology, a combination of cost for these communication technology – that are quite complex things to handle to actually define the right sequence of use cases for implementation so that you can define a good path through that jungle."*

To address that challenge, it is necessary to connect the different products in a way that is standardized across all products. It is thus crucial that connectivity is not handled individually by the different internal business units but in an orchestrated way by a central platform department that collaborates with the business units and that has sufficient power to take decisions and enforce their implementation through control mechanisms. For example, *Tool-Group's* platform unit opted for using the MQTT protocol for communicating with remote devices across all product lines, an internet protocol designed for connections with remote devices in cases where bandwidth might be limited. The goal thereby is to create interoperability between the different products. In a next step, this interoperability might even go further and include products of other companies. The head of connected tools at *Tool-Group* describes the requirement of interoperability for a digital platform:

> *"[…] the benefit lies in connecting a lot of devices that customers might have with each other, even across brand and across manufacturers. So, there is connected tools, connected assets, connected building, connected city, so this is all a full potential of the benefits that come in to play when a lot of things are connected to each other. Now, that obviously requires that you have the opportunity that these devices can communicate with each other, exchange information with each other, and that requires a certain level of standardization, interoperability standards and that is why this is clearly a platform game."*

Compared to *Tool-Group*, *Car-Tec* has already achieved more far-reaching connectivity and interoperability among its cars. As cars are more standardized than tools, it was easier to integrate on-board units for connectivity in all product lines. To establish a digital platform in the next step, it is necessary to decouple the development of the digital platform from the underlying hardware. The development cycles of a digital platform are much shorter than those of cars which take up several years. Furthermore, it has to be ensured that the development process of the platform takes into account the interdependencies with the applications and tools that are built on the platform by other internal business units. At first, *Car-Tec* struggled to establish a development process for the platform that is in line with the requirements of other internal business units:

> *"In the beginning there were massive problems in the older generation [of the platform]. There was a release of an arbitrary new version and randomly things were not working and tools frequently crashed. And we still experience similar things in the current generation, since tools and platform are again concurrently developed."* (Project manager, Car-Tec)

The case of *Car-Tec* also shows the importance that the digital platform is accessible internally to all business units that work on the cars' user interfaces. By creating dedicated project spaces where members of different business units could experiment with the digital platform already in early stages, *Car-Tec* was able to create awareness for the platform project. This sparked ideas for use cases on the platform across different internal business units.

> *"I would say the platform itself has to be as open as possible for an internal utilization. This brings us forward, since we have multiple business units which intend to deploy their products and services into the vehicle and up to now they rely on the development and safeguarding processes of multiple departments."* (Project manager, Car-Tec)

The alignment of internal business units emerged as crucial first step for the device-centric platform ecosystems of *Tool-Group* and *Car-Tec*. For the service-centric platforms of *IS-Corp* and *API-Bank*, overcoming this challenge was easier. As no hardware was involved, the key had been to separate services that are part of the platform core and services that are deployed as complements on the platform. For example, tools that support development on the platform, are part of the platform itself whereas customer-facing applications are complements on the platform. The development of these different services was then decoupled and the communication between the platform and complementary services was standardized with API.

11.4.2 Governance of Core Partners

All five companies have a network of core partners that has been established over the years. These partners support the development of core features, enhance solutions with their industry-specific knowledge, or provide access to specific markets. For example, *IS-Corp* collaborates with partners that add functionality to the core enterprise software system to adapt it for the insurance industry:

> *"[The insurance companies] laughed at us: 'You don't have a clue about the [insurance] industry!' And they were right, [IS-Corp] did not know much about the insurance industry. This is why we have a partner that is experienced with IT solutions for insurances. And the insurance companies said, if we teamed up, they would consider our solutions. That is how this longstanding successful partnership took off."* (Chief partner expert, IS-Corp)

Consequently, the companies have developed governance mechanisms to identify and incentivize suitable partners, and to enable value co-creation. At the same time, onboarding criteria were enforced with partner-specific control processes. *IS-Corp's* global licensing manager describes:

> *"We have a dedicated team called Business Development for Partner Solutions […]. They analyse the [potential] partner solution, they know the market, and they actively get in touch with these partners. Of course, a business case is developed beforehand, [to estimate] what revenue can be expected with that partner. Then, the partner is contacted and a deeper 'due diligence' is conducted. The case is presented to a larger board at [IS-Corp], they scrutinize the revenue, the potential, how the solution is framed, […] whether it overlaps with other products. Do we create competition with our own products or partner products? How does the technology look like? How is the partner's shape, in particular with regard to financial stability? How large is the partner? Can the partner provide 24/7-support?"*

With the shift towards a platform strategy, many of these partners continue to play an important role for the development of the platform core or essential applications on the platform. In some cases, they are even involved in strategic decisions related to the platform ecosystem. For example, *Tool-Group* collaborates with an IT provider to prepare the internal technology for the opening of a third-party ecosystem. Due to its experience in other platform projects, the IT provider also consults *Tool-Group* on how to set up governance for the platform ecosystem.

To govern close partners, the platform owner monitors their activities and the quality of their contributions to the platform. For all our case companies, this is a crucial part of governance as they either provide B2B solutions where low quality would result in losses for the customer, or B2C solutions in critical contexts. Low quality of in-car solutions could pose a risk for drivers and bugs or vulnerabilities in banking services could threat the company's image significantly. A project manager for the platform project at *API-Bank* summarizes:

> *"The main thing is that before we go live with any new [partner] functionality, we have to go through legal obligations and all those business functions which verify if it's ok to go live and then still our business counterpart has to verify if this functionality or the data behind it fits into what people might do with it and therefore if it's okay for the business to provide the data to other people out there or not."*

Some existing close partners of the case companies were pushed to the periphery with the emergence of the ecosystem. They might lose some benefits such as prioritized access to the platform owner's sales channels and quickly find themselves among competing peripheral partners. A sales manager of *ES-Comp* states:

"[T]here we have to really differentiate between those [partners] who co-develop the technology of our platform. That's actually based on the open-source thought. On the other hand, there are partners that generate sales on the platform. For the customer, it does not matter who provides him with the solution. It just needs to be clear that the solution will actually be based on the [ES-Comp] platform and is enriched by a partner."

Governance of core partners therefore also entailed managing changes in the relationships of some partners from a close to peripheral partner. Insights from our cases show that commercially important partners may keep some of their preferential treatments even in their role as strategic partner as the platform owner did not want to risk losing that partner. For example, *IS-Corp* granted some partners more beneficial conditions on the platform and even shielded them from other application developers with similar solutions.

11.4.3 Governance of Peripheral Partners

With the shift to a platform strategy, our case companies aim at leveraging the innovative potential of a periphery of third-party developers. While the companies lack experience in governing relationships with these peripheral partners, their existing customer base facilitates the kick-off of such an ecosystem. Commonly, the 'chicken-egg problem'[25] is inherent to platforms and needs to be addressed by platform governance. But traditional companies can incentivize third-party developers with the access to their existing customer base. A project manager at *API-Bank* states:

"We have critical mass already. […] compared to start-ups, something like the Solaris Bank, who was also offering banking-as-a-service to start-ups. But their problem is that they can only offer a backend but they cannot offer customers. On our platform, we have several million customers. The thing is that for our platform, the external developers will be able to access […] all our customers. […] So, from a development perspective there is a million or whatever pool of potential customers."

In addition to existing customers, traditional companies also have existing partners that are ready to implement first use cases on the platform. These use case can quickly make the platform attractive for customers and other third-party developers. The case of *ES-Comp* illustrates how first use cases were jointly developed with existing partners. An innovation manager of *ES-Comp* states:

"As part of a project series we combined our expertise with know-how from partners to jointly develop first applications on the platform. In these projects, the know-how about the platform and how it can be used was transferred to the partner."

Once platform owners have kicked off the platform ecosystem, our case companies needed to adopt new governance approaches. Instead of close governance that is tailored to individual

[25] The 'chicken-egg problem' refers to the challenge that third-party developers have no incentive to offer applications on a platform that does not have customers. Vice versa, a platform without application does not attract customers (Caillaud/Jullien 2003).

core partners, open governance is required that is able to simultaneously manage a large number of third-party developers. A project manager of *API-Bank* illustrates the difference between the two governance approaches as follows:

> *"I think the biggest difference between a partner approach and an open [approach] is that in the partner approach you are entering a specific and individual business agreement with a specific partner where there is a lot more responsibility on the bank's side, which is more the classical model where you have to do vendor risk management and other things, which is all very expensive and very time consuming. Whereas in the open case, most of the responsibility isn't with the bank. It is a very, very clearly defined interface with generic conditions with no special terms regarding the API consumer."*

The project manager mentions a central element of governing peripheral partners: clearly defined interfaces between the platform core and the peripheral partners and a provision of standardized boundary resources for the peripheral partners. The interfaces themselves are important but not sufficient – only boundary resources make them valuable for peripheral partners. For example, APIs need to be accompanied by documentation and sample implementations to be easily usable by third-party developers. All our case companies already had boundary resources available or were in the process of preparing them. *IS-Corp* with the most advanced platform ecosystem from our sample also has the broadest range of boundary resources available for third-party developers, as one external developer in the *IS-Corp* ecosystem describes:

> *"There are wikis, social media websites, or blogs where people inform other people on what they did; you find tutorials, Q&As, FAQs. Then there is [IS-Corp's] academy, a YouTube channel, which is also a key part in getting the knowledge out there on how to develop on [the IS-Corp platform] and how to get started and – even more complex – what functionalities one can use. […] [these sources] are giving a good starting point for everyone just to get started, and if they get stuck in a problem that is deeper and it is not answered […], they can still contact the development or the representative who sold them the [IS-Corp platform] instance."*

Similarly, a project manager at *API-Bank* is convinced that comprehensive and easy-to-use boundary resources are key to *"spark innovation"* in platform ecosystems. To not limit the creativity and generativity of peripheral partners, they are granted autonomy related to their applications. For example, they do not have to stick to given development processes or use specific technologies. Creativity and generativity are further sparked through developer communities that peripheral partners are part of. In online communication platforms such as forums and blogs as well as at events such as developer conferences, third-party developers exchange ideas, get feedback on their solutions, and find solutions for their problems. The quality of third-party applications in the platform ecosystem is then ensured with outcome-based control such as approval processes for each application submitted to the platform ecosystem. Furthermore, as part of a developer community, third-party developers underlie an informal control through their peers in the community.

11.5 Discussion and Theoretical Integration

In this section, we discuss the findings of our multiple case study in view of the theoretical pre-understanding on platform governance. First, we summarize and reflect on the three layers of governance in platform ecosystems of traditional companies: (1) internal business units, (2) core partners, and (3) peripheral partners. Second, we discuss how internal and external complexity affect the governance choices of traditional companies across these layers. Lastly, we summarize our contributions to theory and practice.

11.5.1 A Multi-Layer Perspective on Platform Governance

Our theoretical pre-understanding of platform governance entails that the platform owner exclusively controls the platform core and governs a periphery of third-party developers (Tiwana 2014; Ghazawneh/Henfridsson 2013). While this understanding is applicable to digital-native companies that create platform ecosystems on a green field, our cases show that the situation is more complex for traditional companies that shift towards a platform strategy. We shed light on the black box of the platform core and show that traditional companies need to consider multiple layers of stakeholders in their platform governance approaches (Figure 34).

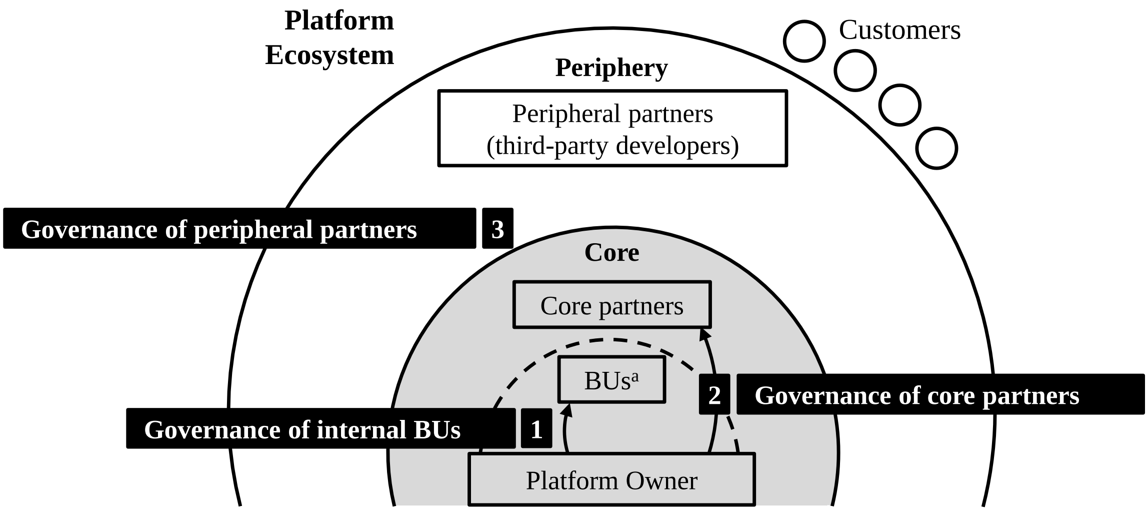

Figure 34. Revised Theoretical Understanding: Multi-Layer Platform Governance for Platform Ecosystems of Traditional Companies ([a] Business units)

To describe the governance approaches taken across the three layers, we take into account the dimensions decision rights, control, and boundary resources (Tiwana/Kim 2015; Tiwana 2014). **Governance of internal business units** has emerged across our cases as a double-edged sword that requires the platform owner's strategic attention. On the one hand, traditional companies need to grant internal business units sufficient freedom to explore possible avenues for digital platforms. It has been shown that internal ideas and initiatives can only be successful if they are granted space to be developed (Henfridsson/Yoo 2014). This is particularly the case if the initiatives go beyond a company's current capabilities as it is often the case with platform initiatives.

On the other hand, to successfully implement a platform ecosystem, hierarchical governance with the goal to align the business units' activities on the digital platform is required. Otherwise, different independent platform projects might emerge, none of them having a chance to reach critical mass. In our cases, we observed a two-phased approach in which business units were granted decisions rights as part of a loose governance at first but once a promising platform emerged, the corporate centre or the dedicated unit that is responsible for the platform project centralized decision rights. It defined internal standards that the business units have to adhere to, for example to synchronize development cycles of the platform core and the business units' products and services. The adherence to internal standards is ensured by different control mechanisms such as process control (e.g., joint development across business units) or output control (e.g., code reviews of applications)(Tiwana 2014). For example, the launch of *Car-Tec's* in-car infotainment platform was only possible because the company was able to restructure the IT infrastructure in the car as part of a cross-business unit project.

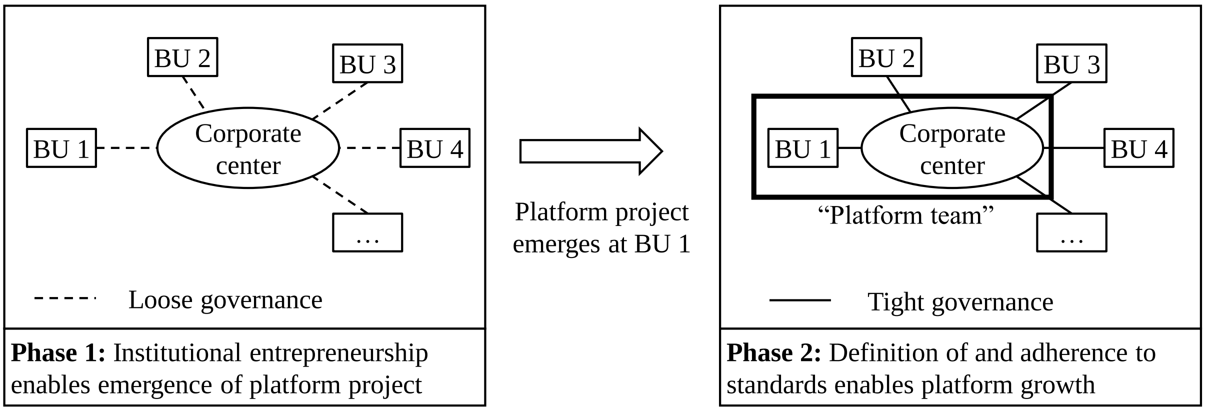

Figure 35. Governance of Internal Business Units (BUs) and its Development During the Emergence of a Platform Project

Our results also show that traditional companies have close ties with partners that have contributed in different ways to the companies' products and services. **Governance of core partners** thus relates to the question what roles these partners take on in an emerging platform ecosystem. Longstanding partners can be of crucial importance to continuously develop the platform core, given the path dependencies that their collaboration entails (Huotari/Ritala 2016; Grover/Kohli 2012). Therefore, the platform owner often shares decision rights with these core partners and grants further benefits such as shared revenue in order to secure their continued support. At the same time, the platform owner also needs to control the activities of core partners. Similar to internal business units, process control is applied to ensure that core partners are aligned with the platform ecosystem goals. However, instead of hierarchical governance, contractual governance can be used to implement control mechanisms with contractual penalties in case of violations. For example, *IS-Corp* collaborates with core partners that provide micro-services and tools on the platform. The core partners have to fulfil the same quality requirements as internal solutions of *IS-Corp*, which is determined in the partner contracts. While core partners traditionally are supported with individualized boundary resources and relationship-specifically customized IT, platform owners try to iteratively standardize IT-based transactions with core partners. For complex ecosystems particular in B2B contexts, a verticalization approach can help to govern collaboration with core partners. Through vertical clusters on the horizontal platform, specific industries are targeted with a pre-defined set of platform functionalities and third-party applications. The platform owner typically collaborates with core partners that have experience in the respective industry to create a foundation for additional third-party applications. However, we also observed some existing core partners that shifted to the periphery. This transition had to be managed by the platform owners in order to not upset these partners that could still contribute to the platform's commercial success.

Governance of peripheral partners is looser than governance of core partners in order to maximize generativity in the broader platform ecosystem. Third-party developers are granted autonomy to choose technologies and frameworks, work along their own development cycles and interact with customers. However, they do not have decision rights regarding the platform core. For example, they do not have direct influence on what features will become part of the platform core or how APIs are defined. As the developers are granted autonomy, platform owners rely on outcome-based control mechanisms to ensure quality standards. Additionally, informal control through developer communities emerges as soon as vibrant communities of third-party developers have been established. From an architectural point of view, the platform owner aims at standardizing the interfaces between the platform core and complementary application along with providing standardized boundary resources to ensure the greatest possible accessibility and ease-of-use. For example, *API-Bank* invested much time and effort to create APIs supported by a developer portal with comprehensive material for potential third-party developers. Table 45 provides a summary of the three layers of governance we identified.

Layers of governance	Dimensions of governance		
	Decision rights	**Control**	**Boundary resources**
Internal business units	▪ Decentralized decision rights to enable organizational entrepreneurship ▪ Centralization of decision rights in corporate centre once a platform is implemented in large scale	▪ Process control to enforce internal standards once a platform is implemented in large scale	▪ Internal standardization and modularization ▪ Interoperability of products and services ▪ Decoupling of development of platform core and complements
Core partners	▪ Joint decisions on development of core ▪ Decision rights related to partner solutions partly granted to partners	▪ Process control through coupled processes (e.g., development cycles) ▪ Control of onboarding criteria ▪ Contractual penalties	▪ Stepwise standardization of boundary resources ▪ Reduction of relationship-specific customization ▪ Verticalization of platform offering
Peripheral partners	▪ Application-related decision rights granted to third-party developers ▪ Platform-related decision rights centralized at the platform owner	▪ Focus on outcome-based control (i.e., quality control of applications) ▪ Informal control through developer communities	▪ Focus on accessibility and ease-of-use of the platform ▪ Standardized interfaces (APIs) and boundary resources

Table 45. Platform Governance for Platform Ecosystems of Traditional Companies

Our three-layered framework of platform governance represents an important contribution to literature on digital platforms and, more broadly, on IT governance. Previous research on digital platforms has focused on the governance of third-party developers (Tiwana 2014; Ghazawneh/Henfridsson 2013). Third-party developers are peripheral partners of the platform owner who, according to the theoretical pre-understanding, is in exclusive control of the platform core (Parker et al. 2016; Baldwin/Woodard 2009). We shed light on the platform core which – in the case of traditional companies – is a network of internal business units and existing partners that need to be governed as well.

We contribute to literature on IT governance by specifying the dimensions of "who is governed" for platform ecosystems of traditional companies (Tiwana/Kim 2015; Tiwana et al. 2013), acknowledging different internal and external stakeholders beyond just third-party developers. By highlighting the multi-layered structure of platform governance, we enhance literature of hybrid governance modes that combine tight and loose governance in interfirm networks (Makadok/Coff 2009; Reuer/Devarakonda 2016). Platform ecosystems as special case of interfirm networks benefit from the interplay of tight and loose governance because it not only enables generativity but allows to channel that generativity in a way that value is created for the participants.

For the governance of internal business units, we raise new questions such as how much autonomy internal business units should be granted to enable organizational entrepreneurship that can lead to platform projects (Burgelman 1991; Dixon et al. 2017), when to engage in more hierarchical governance to ensure the success of a platform and how to manage this transition. For the governance of core partners, interesting questions arise such as how to identify the most important partners for developing the platform core and how to manage the transition of former core partners to the periphery once they are no longer of strategic importance.

This more detailed view on the different stakeholder groups that are governed in platform ecosystems allows us to contribute to the ongoing discussion of balancing openness and control (Benlian et al. 2015; Boudreau 2010; Ghazawneh/Henfridsson 2013). A high degree of openness supports a high quantity and variety of complementary applications but comes along with reduced possibilities to control the activities and outcomes in the platform ecosystem. Vice versa, strict control is implemented to ensure quality and other standards but, in turn, reduces the platform's openness and thus its generativity. Traditional companies hesitate to open their technology towards third-party developers as they assume that their technology comprises some of their competitive advantage. In particular companies that offer critical services such as *API-Bank* with banking services, want to stay in control of their platform. We show that differentiating core partners and peripheral partners helps to implement mixed governance approaches in which the core is relatively close and governed with tight control while the periphery is open and governed with loose control.

Our results also entail insights for practice. On the one hand, we show that traditional companies can leverage their existing business units and partners as competitive advantage in the face of digital newcomers entering the market. Both business units and partners have existing customer-facing channels that can be used to sell platform applications. This access to customers is a major incentive for third-party developers to join the platform ecosystem. The chicken-egg-problem which is inherent to platforms (Caillaud/Jullien 2003; Evans/Schmalensee 2010) is thus less crucial in platform ecosystems of traditional companies. On the other hand, taking into account the needs and expectations of existing partners is important for the success of platform ecosystems. Treating existing partners as common third-party provider might affront them as they had a privileged relationship to the platform owner before. Thus, individual solutions on how to move existing partners onto the platform are required.

11.5.2 Complexity and Platform Governance Approaches

Our analysis of platform ecosystems of traditional companies has shown that differing degrees of internal and external complexity affect the way internal business units, core partners, and peripheral partners are governed. Following the antecedent-governance-consequence framework (Tiwana et al. 2013), we suggest that complexity acts as antecedent of platform governance. Thus, to create a successful platform ecosystem as consequence, the interplay of complexity and platform governance should be discussed. We summarize the findings in Table 46.

Complexity	Platform governance approach	Focal governance layers
High internal complexity	**Close core governance** ▪ Focus on internal standardization and interoperability enforced by a platform business unit that possesses centralized decision rights ▪ Early interaction between third-party developers and business units to consider requirements ("pre-opening phase")	▪ Internal business units ▪ Peripheral partners
High external complexity	**Network core governance** ▪ Focus on collaboration with core partners to verticalise the platform as part of a joint platform development ▪ Governance of relationship between core and peripheral partners to remain focal actor in the ecosystem	▪ Core partners ▪ Peripheral partners

Table 46. Effect of Complexity on Platform Governance

Internal complexity results from the products and services that a traditional company wants to be part of the platform ecosystem. Our cases show that internal complexity is particularly high in device-centric ecosystems. Different product lines with different development and life cycles, different components and different approaches to connectivity create a *"jungle"* through which a good path has to be found, as the product owner of *Tool-Group's* digital platform illustrated. The cases of *Tool-Group* and *Car-Tec* with their device-centric platform ecosystems helped us to carve out a governance approach in the case of high internal complexity. We refer to that approach as **close core governance.** The focus of close core governance lies on creating internal standardization and interoperability enforced by a platform business unit that possesses centralized decision rights. In a pre-opening phase that comes before actual collaboration with peripheral partners, the internal structure of the platform owner is changed drastically to lay the basis for modularity and extensibility. Therefore, close core governance aims at governing internal business units within the platform core, which is not accessible for external partners. While the platform is not open to the outside in the pre-opening phase, it is important that business units already interact with future third-party developers to understand their requirements and to test interfaces or boundary resources.

External complexity results from outside of a company's boundaries such as from fragmented, unstructured markets and networks of heterogeneous partners. External complexity was particularly high for the cases of *IS-Corp* and *Tool-Group* who both address complex B2B markets. To accommodate for high external complexity, the companies applied a governance approach that we refer to as **network core governance**. The focus of network core governance lies on collaboration with a network of core partners to verticalise the platform as part of a joint platform development. Together with core partners, the platform owner structures the core of the platform in different vertical offerings that address a specific market. A vertical offering thereby includes the infrastructure, services and applications needed to enable one use case of a specific industry. For example, *IS-Corp* has established verticals together with partners for the insurance industry. In the next step, the platform core with its verticalised structure is opened to peripheral partners, that is, third-party developers. These third-party developers can contribute applications to the platform's vertical offerings. The platform owner has to carefully govern the relationship between core and peripheral partners in order to remain focal actor in the ecosystem. Otherwise, core partners together with third-party developers can build an own platform ecosystem around one of the vertical offerings reducing the platform owner to a replaceable infrastructure provider.

This discussion contributes to literature on platform governance in several ways. First, we enhance platform governance literature by a specific antecedents-governance-consequences model. Literature up to now has mostly focused on identifying governance mechanisms and understanding how they work (Qiu et al. 2013; Goldbach/Benlian 2014; Goldbach/Kemper 2014). Analyses on how possible antecedents such as complexity affect the choice and implementation of governance mechanisms are rare. Second, we address the call for research on platform ecosystems that does not reduce real-world complexity by relying on abstract models (Tilson et al. 2012b, 2013) and confirm that both internal and external complexity has to be accounted for to create successful platform ecosystems.

11.5.3 Limitations and Future Research

Our study is subject to limitations that entail pathways for future research. First, the selection of five cases as part of our exploratory multiple case study challenges the generalizability of our results (Yin 2014). Through the theoretical sampling approach we were able to include cases that exhibit varying degrees of internal and external complexity. However, generalizing the findings for all traditional companies that implement platform ecosystems has to be done with caution. Other antecedents than complexity might play a role in the antecedents-governance-consequences framework that we started to map (Tiwana et al. 2013). Other studies that focus on this framework in different contexts such as different industries, different company sizes or different regions will provide helpful insights. It would also be worthwhile for future research to analyse in how far our findings can be applied to platform ecosystems of digital-native companies that have grown more complex over time. In recent contributions, discussions of an "ecosystem of ecosystems" (Walton 2017, 152) or "platform of platforms" (McAfee/Brynjolfsson 2017, 137) have emerged that entail a more complex structure of platform ecosystems than the basic core-periphery structure. Elements of close core and network core governance approaches might be relevant in such settings.

Second, we are not able to claim for sure that the platform ecosystems we analysed will be successful, which represents a limitation for the validity of our results on platform governance. We accounted for that limitation by choosing successful traditional companies that were dedicated to put sufficient time and effort into the platform project and by evaluating the success of the platform ecosystems early on as part of the qualitative case analysis. Still, traditional companies that have a seemingly good starting position may fail, as illustrated by the example of Covisint, a failed supply platform established by established automotive manufacturers (Alstyne et al. 2016). Thus, it would be worthwhile to take on a longitudinal perspective and trace the success of platform ecosystems over a timespan of three, five or even more years. Grounded theory studies that allow to capture rich details on the evolution of platform governance applied by traditional companies over time could be one way to enrich our theoretical understanding (Wiesche et al. 2017; Urquhart 2013). We hope that our work will trigger more research that considers the increasing heterogeneity of platform in IS and brings platform theories forward.

Part C

12 Summary of Results

With the eight publications embedded in this thesis, we addressed the three research questions that guided our research endeavor. Below, we summarize these results for each research question before discussing their implications in the next section.

RQ1: *What does literature contribute to our understanding of governing value creation in digital platform ecosystems?*

Synergistic perspectives on digital platform ecosystems. Based on a literature review (P1), we identified a technology- and a market-oriented perspective on digital platform ecosystems. Both perspectives highlight different characteristics of digital platforms and their ecosystems. While the technology-oriented perspective focuses on the platform as IT artefact that can be enhanced by complementary products, the market-oriented perspective highlights the role of digital platforms as intermediaries in two-sided markets. As digital platform ecosystems such as Google's Android or Apples iOS are typically based on an extensible digital platform while offering a marketplace, both perspectives need to be considered jointly. According to these perspectives, different governance mechanisms are suggested in IS literature.

Mechanisms of platform governance. Based on the two perspectives on digital platform ecosystems—technology- and a market-oriented perspective—we identified several governance mechanisms relevant for value creation: roles, pricing and revenue sharing, boundary resources, openness, control, technical design, competitive strategy, and trust. Those mechanisms have all been discussed from both perspectives but besides pricing and revenue sharing, and competitive strategy, the majority of studies in our review took on a technology-oriented perspective. For each mechanism that we identified, we provide several aspects that have been discussed in the respective articles dealing with that mechanism. For example, the mechanism of openness covers the aspects granting access to technology and giving up control over technology and the mechanism technical design covers the aspects modularity, interfaces, and compatibility.

RQ2: *What mechanisms do platform owners apply to govern value co-creation and value capture in digital platform ecosystems?*

Degree of openness and governance of collaboration. Based on the results of our literature review (P1) we engaged in several exploratory case studies. The first case study on a banking company (P2) revealed that the degree of openness of a platform and the governance of collaboration are important factors that contribute to value co-creation in digital platform ecosystems. While these aspects had already been discussed in literature as important factors, we provide details on how these mechanisms contribute to value co-creation and what role the context of a traditional company plays for the effect of these mechanisms. In particular, for traditional companies, internal resistance and criticality of technology negatively impact the contribution of openness to value co-creation, while internal transparency and standards have a positive impact. Furthermore, migration of partners and an image of being inert negatively impact the contribution of governance on value co-creation while the fact that customers and partners are already part of the ecosystem has a positive impact. In addition, we found that the threat to existing business and loss of access to customers directly affect value co-creation negatively while absorption of third-party developers has a positive impact.

Absorption, co-selling, and verticalization as mechanisms of value capture. In a further case study on an enterprise software vendor (P3), we showed that value capture is an important and understudied element of value creation in digital platform ecosystems. We identified three mechanisms of value capture: absorption, co-selling, and verticalization. We thereby highlight that value capture and value co-creation are distinct elements of value creation in digital platform ecosystems. While they are distinct mechanisms, they need to be considered jointly because they interact with each other. For the three mechanisms of value capture we found different interaction effects with value co-creation: negative for absorption, positive for co-selling, neutral for verticalization. Thus, when considering options to capture value, platform owners need to take into account possible impeding effects on value co-creation.

Platform governance mechanisms in nonprofit platform ecosystems. In a third case study (P4), we analyzed platform governance mechanisms for a nonprofit platform ecosystem. Along the dimensions of governance structure, accessibility and control, trust, and boundary resources, we derived recommendations on how governance can be applied. This revealed differences in the application of platform governance between commercial and nonprofit platform ecosystems. For example, for nonprofit platform ecosystems centralization of governance is balanced against chartering and representation instead of pricing and boundary resources need to be designed in an individualized rather than in a standardized way.

RQ3: *How can traditional companies successfully shift toward a digital platform strategy?*

Coping strategies of partners impacted by a shift toward digital platform ecosystem. To answer the third research question, we dived deeper into the challenges of traditional companies when shifting toward a digital platform strategy. In a first study (P5), we identified three strategies how partners react to such a drastic change: partners (1) embrace, (2) slow down, or (3) repurpose the change. For traditional partners it is important to understand and anticipate these reactions in order to mediate possible negative effects of these coping strategies through specific actions. These results highlight that it is important to also take on the viewpoint of third-party developers (in this case partners) to understand the impact of platform governance mechanisms.

Capabilities required for a successful strategic shift and how to develop them. In a case study of an established software vendor (P6) we found that traditional companies that shift toward a digital platform strategy need to develop five capabilities. These platform capabilities cover cloud-based modularization and open IT on the level of technology, ecosystem management and platform evangelism on the level of governance, and platform co-selling on the level of market. While other capabilities might also be helpful to set up digital platform ecosystems, these five capabilities emerged as most important ones from the case study. To develop these capabilities, companies need to transform existing capabilities by (1) accelerating, (2) scaling, (3) deregulating, and (4) aligning underlying organizational routines as part of an iterative capability transformation process. We highlight that it is required to understand changes on the level of organizational routines if changes on the level of capabilities are envisaged.

Governing customers as developers. With a further in-depth case study on an enterprise software vendor (P7), we focused on the transition of a product platform to a digital platform ecosystem and identified customers as developers as key actors with regard to this transition. We developed a process model for the process of transforming a product platform toward a platform ecosystem with 'enabling customers as developers' as focus in the first phase and 'increasing scalability across customers' as focus in the second phase. These results show that in digital platform ecosystems, the clear distinction between third-party developers and users of applications is not always possible. If we consider complex digital platforms that mainly address business-to-business, customers often have so specific requirements that there are no third-party solutions available. These customers then engage in their own development of complementary products.

Governance on multiple layers. With a multi-case study targeting several traditional companies that shift toward a platform strategy (P8), we found that platform governance relates to three different layers: platform governance on the layer of (1) internal business units, (2) core partners, and (3) peripheral partners. When an emerging platform owner starts by re-organizing governance of internal business units to prepare a platform strategy, platform governance on the higher layers can be implemented more easily. We thus find that platform governance for traditional companies does not address a simple set-up of a digital platform with its periphery but addresses digital platforms along the multi-layer framework of platform governance. Furthermore, we found that internal and external complexity affects the way companies apply platform governance across the three layers.

Table 47 gives an overview on the key findings of this thesis.

P	RQ	Findings
P1	RQ1	▪ Two different perspectives on digital platform ecosystems that need to be considered jointly: technology- and market-oriented perspective ▪ Roles, pricing and revenue sharing, boundary resources, openness, control, technical design, competitive strategy, and trust as key concepts for the design and governance of digital platform ecosystems ▪ Three issues for future research on digital platform ecosystems: (1) Integrating different perspectives on platform ecosystems with design and governance concepts, (2) an individual level of analysis for end-users and complementors, and (3) data as boundary resources in digital platform ecosystems
P2	RQ2	▪ Degree of openness and governance of collaboration influences value co-creation in digital platform ecosystems ▪ For traditional companies, internal resistance and criticality of technology negatively impact the contribution of openness to value co-creation, while internal transparency and standards have a positive impact ▪ For traditional companies, migration of partners and an image of being inert negatively impact the contribution of collaboration governance on value co-creation while the fact that customers and partners are already part of the ecosystem has a positive impact ▪ Threat to existing business and loss of access to customers directly affect value co-creation negatively while absorption of third-party developers has a positive impact

Table 47. Overview on Key Results

P	RQ	Findings
P3	RQ2	▪ Value capture as important and understudied element of value creation in digital platform ecosystems ▪ Three mechanisms of value capture: absorption, co-selling, verticalization ▪ Interaction effects of the three mechanisms of value capture with value co-creation: negative for absorption, positive for co-selling, neutral for value capture
P4	RQ2	▪ Platform governance recommendations for nonprofit platform ecosystems along the dimensions of governance structure, accessibility and control, trust, and boundary resources ▪ Differences in the application of platform governance between commercial and nonprofit platform ecosystems. For example, for nonprofit platform ecosystems centralization of governance is balanced against chartering and representation instead of pricing
P5	RQ3	▪ Three strategies how partners in an ecosystem that shifts toward a digital platform strategy react to that change: (1) embrace, (2) slow down, or (3) repurpose the change. ▪ The platform owner can mediate the effects of these strategies through specific actions
P6	RQ3	▪ Five capabilities that companies need to develop when shifting toward a digital platform strategy ▪ These capabilities cover cloud-based modularization and open IT on the level of technology; ecosystem management and platform evangelism on the level of governance; and platform co-selling on the level of market ▪ To develop these capabilities, companies need to transform existing capabilities by (1) accelerating, (2) scaling, (3) deregulating, and (4) aligning underlying organizational routines
P7	RQ3	▪ Customers as developers as the key actors in the first phase of the transition from a product platform to a platform ecosystem ▪ Process model for the process of transforming a product platform toward a platform ecosystem with ‘enabling customers as developers’ as focus in the first phase and ‘increasing scalability across customers’ as focus in the second phase ▪ Contextualization of the transformation from product platform to platform ecosystem with regard to technological advances and the enterprise software context
P8	RQ3	▪ Traditional companies that shift toward a digital platform strategy apply governance on multiple ecosystem layers to manage the collaboration among (1) internal business units, (2) core partners, and (3) peripheral partners. ▪ Internal and external complexity affect the way companies govern these three stakeholder groups

Table 47. Continued

13 Discussion

Based on the summary of our results we describe discussion themes that are of interest with regard to the body of knowledge. We reflect on the extensions of the standard model of digital platform ecosystems, governance challenges for traditional companies, and the make or buy decision that traditional companies face when shifting toward a digital platform strategy.

13.1 Going Beyond the Standard Model of Digital Platform Ecosystems

Several of our case studies revealed that the standard model of digital platform ecosystems is not sufficient to capture the complexity of real-world digital platform ecosystems. As standard model, we interpret the established view of digital platform ecosystems as consisting of a digital platform at the core on which third-party developers and users interact (Tiwana 2014). This standard model has been of crucial importance to understand the basic mechanisms of digital platforms and the platform economy such as indirect network effects (Song et al. 2017), single- and multihoming (Cennamo et al. 2018), and platform governance (Tiwana et al. 2010). But the model is also a simplification that builds on ideal types of digital platforms such as mobile phone operating system platforms or video gaming platforms.

The digital platform ecosystem that we analyze in the banking industry (P2), enterprise software industry (P3, P5, P6, P7), automotive industry (P8), equipment manufacturing industry (P8) and the nonprofit sector (P4) have proven to be more complex and thus require a more nuanced application of platform governance. We describe factors that drive complexity below (Table 48).

Factor	Description	Example
Verticalization	Given the complexity of the customers' use cases, vertical solutions are created that do not scale across the digital platform ecosystem.	In the industrial IoT customer use cases often require integration with a very specific setup of machines and equipment (see P3 and P8).
Blurring roles	The roles of third-party developers and users blur, further roles such as consultants emerge.	In the ecosystem of an ERP vendor, many customers develop applications for their own use (see P7).
Multi-layered ecosystem	The digital platform ecosystem includes several layers such as an internal core layer, a layer of strategic partners, and a layer of third-party developers.	Across several digital platform ecosystems from different industries, platform owners prioritized strategic partners compared to the broader periphery of third-party developers (see P8).
Open hardware and data layers	The hardware and data layers are open to various devices not necessarily controlled by the platform owner.	In the enterprise software context, digital platforms build on an individual setup of machines and processes at each customer (see P6).

Table 48. Factors Driving Complexity of Digital Platform Ecosystems

The first factor that drives complexity in digital platform ecosystems is **verticalization**. With verticalization we refer to an increasing degree of vertical solutions on the digital platform that address specific customer needs and do not scale across the ecosystems. These vertical solutions typically include more than just an application. They also cover integration with customer- or industry-specific data sources. Vertical solutions are thereby often initiated by the platform owner to offer the customer a bundled solution rather than digital platform where customers pick their own applications. As a result, platform owners not only need to manage the ecosystem of third-party developers but also the portfolio of vertical solutions that the platform owner is involved in. For example, in the industrial IoT customer use cases often require integration with a very specific setup of machines and equipment (see P3 and P8).

Secondly, we observed **blurring roles** in the digital platform ecosystems we studied. In particular customers often acted as developers to develop solutions for their own purposes. Reasons for customers becoming developers were that they did not find suitable solutions in the ecosystem or that they wanted to stay in full control of software that was related to the core business processes. This blurring of roles complicates platform governance as the platform owner needs to adapt governance approaches to cater for customers as developers. They require higher degrees of compatibility of the digital platform given their IT legacy, they require individualized boundary resources, and they cannot be priced with a regular revenue sharing approach given that they do not directly generate revenue with the solution. For example, in the ecosystem of an ERP vendor, many customers develop applications for their own use and the vendor adapted their governance approach to consider this group of developers (see P7):

> *"[Third-party developers] played a minor role on the platform. It was more about internal use cases. The platform is used for an internal application or for customers that want to renew their IT landscape—an agile layer on top of their ERP systems. So, it is not the large marketplace where we have many partner applications on the platform, I don't see that."* (Member of the platform team at SAP, referring to the situation in 2015, I3)

Third, we found that digital platform ecosystems—in particular those developed by traditional companies—are **multi-layered**. There is not just a core and a periphery but also a layer of strategic partners that are more closely related than typical third-party developers. In many cases these partners are also involved in developing or contributing to the core itself. These partners need to be governed as strategic partners (Capaldo 2007; Gulati 1998; Reuer/Arino 2007) rather than third-party developers. In our study P8, across several digital platform ecosystems from different industries, we found that platform owners prioritized strategic partners in the early phase of the platform compared to the broader periphery of third-party developers (see P8). Furthermore, we highlighted that also the core layer itself requires dedicated governance because internal business units are involved in managing the core. Platform owners face a tradeoff in granting freedom to internal business units in order to let room for them to come up with innovative platform approaches. But once a promising digital platform has been identified, internal business units need to be aligned on the platform. A team manager from an automotive manufacturer highlights the need for governance targeted at internal business units:

> *"I would say the platform itself has to be as open as possible for an internal utilization. This brings us forward, since we have multiple business units which intend to deploy their products and services into the vehicle and up to now they rely on the development and safeguarding processes of multiple departments."* (I102)

A fourth driver of complexity is that in the digital platform ecosystem we analyzed, the platform's underlying **hardware and data layer is open**, thus not encapsulated in the platform core itself. In the standard model, the core is assumed to encapsulate the hardware and data layer because the model is built on digital platforms such as mobile phone application platforms or video gaming platforms. In these digital platform ecosystems, the devices are either completely controlled by the platform owners because they also manufacture the devices—as for example Apple does with iOS devices or Microsoft does with the Xbox—or the platform owners require device manufacturers to adhere to specific standards—such as Google does with Android device manufacturers. In the digital platform ecosystems we studied, the digital platforms build on an open hardware and data layer where each customer has an individual setup that the digital platform has to build on. For example, in the enterprise software context, digital platforms build on an individual setup of machines and processes at each customer (see P6). Thus, the platform owner has to apply platform governance to work towards standardization in the digital platform ecosystem. For example, when the enterprise software vendors sell their cloud platform to customers, the goal is to standardize the customers' business processes wherever possible rather than customizing the platform.

The factors driving complexity in digital platform ecosystems result from the context of the ecosystems. The environment in which an enterprise software cloud platform is created by a traditional software vendor differs from the environment in which a cloud-native startup launches a digital platform. As we have seen in our case studies, the differences in the context affects the requirements for platform governance. By being sensitive to contextual factors, we are able to contextualized established theories on governance of and value creation in digital platform ecosystems by adding and enhancing constructs of platform governance (Hong et al. 2014; Davison/Martinsons 2016).

13.2 The Platform Governance Challenge for Traditional Companies

Traditional companies face the challenge of digital transformation (Sebastian et al. 2017). By adopting new technologies and re-organizing their business, traditional companies try to compete with digital newcomers that enter their markets. Thereby, platform ecosystems are often seen as panacea because they help traditional companies to benefit from innovative capabilities outside of the companies themselves.

The trend toward digital platforms is strengthened by the fact that traditional companies observe the success of digital newcomers with digital platforms. With these digital platforms, newcomers threaten to envelop the business of traditional companies if they are not able to protect it. For example, Salesforce achieved huge success in the market for CRM software with its platform for complementary applications (Baek et al. 2014), threatening the business of existing software vendors. Furthermore, some traditional companies have already implemented digital platforms and these examples are repeatedly referred to as best practices by other traditional companies even though it is still unclear whether they will be successful in the long run. For example, the German equipment manufacturer Trumpf with its spinoff Axoom is often described as a success story how a digital platform can be created in a traditional industry (Trumpf 2015). But Axoom has yet to prove to become a success in the industrial IoT. A project member of the banking company we studied highlights the trend towards platform ecosystems:

> *"I think, there's this idea of creating a platform ecosystem, probably people love to talk about way better examples of platform businesses…The dream is that the bank*

> *is an ecosystem of services which addresses the people's real-world issues, in a financially driven way. I think this is one trend."* (I72)

Once traditional companies decide to shift toward a digital platform strategy, they face significant challenges with regard to platform governance—challenges that go beyond those of digital newcomers. These challenges have come up in several of the case studies embedded in this thesis. They are not only of practical value for traditional companies that want to shift toward a digital platform strategy, but they are also of theoretical interest. Platform governance has mostly been discussed with regard to already successful platform ecosystems where the challenges that traditional companies face particularly in the early phase are not relevant.

Across our case studies, we identified internal resistance, partner migration, image of being inert, and capability transformation as challenges for traditional companies. **Internal resistance** is triggered when the platform approach changes the way the traditional company has worked before, for example, because formerly internal products can now be created by third-party developers. A member of the platform team at a banking company described:

> *"The [concern] is that the understanding of partnering and that the business can change, is also a change in the mind-set. Probably you are afraid that in a future world your role might look different. All these things. Bottom line is, […] understanding the API as well as what would it mean for the organization and the person who you are talking to."* (I73)

Overcoming internal resistance is thus an issue for governance, in particular in the launch phase of platforms. This adds to the known issues in the launch phase which focus on reaching critical mass quickly with different launch strategies (Evans/Schmalensee 2010; Schirrmacher et al. 2017). **Partner migration** is a governance challenge because it would be beneficial for the digital platform ecosystem if existing partners onboard quickly to provide first applications. This relates to literature on incentivizing third-party developers (Tiwana 2014; Manner et al. 2013b) with the difference that these third-party developers are already partners of the platform owner. We identified different strategies for partner migration such as building illustrative use cases early on, engaging in dialogue with partners to understand adoption barriers, or even increasing pressure for adoption. Furthermore, traditional companies often face the **image of being inert** which might impede new third-party developers from outside the existing network to join. In particular startups might not identify digital platform ecosystems of traditional companies as their first choice for a platform to offer their applications. Thus, platform owners need to actively shape their image, for example by founding a spinoff such as Trumpf did with Axoom or by engaging with the startup community through hackathons. These results also add to literature on incentivizing third-party developers to join the platform ecosystem and establishing trust within an ecosystem (Goldbach/Benlian 2015a). Lastly, we highlighted the need for traditional companies to **transform their existing capabilities** with regard to platform governance and beyond. For example, platform owners need to develop ecosystem management and platform evangelism capabilities in order to successfully incentivize and manage third-party contribution to the ecosystem. Along with capabilities on the technology and market level, these findings relate to the ongoing discussion on what capabilities are actually required to successfully create and run digital platform ecosystems (Helfat/Raubitschek 2018) (Teece 2018).

Despite these challenges, traditional companies also have advantages when shifting toward a digital platform strategy. In particular, they have an existing customer base, and in many cases also a partner base that can help to quickly reach critical mass—one of the key issues when launching a digital platform (Evans 2009; Evans/Schmalensee 2010).

13.3 Digital Platforms: The Make or Join Decision

Given the challenges that traditional companies face it is questionable whether a digital platform strategy is the right approach for every company. Examples of failed digital platforms or platforms with limited success show that a platform strategy can be the wrong approach. For example, GE is trying to sell off its digital division including its platform for the industrial IoT Predix (Edwards 2018).

An alternative to creating a digital platform can be to join an existing digital platform ecosystem as partner. It has been shown that joining a platform ecosystem is beneficial for independent software vendors (Ceccagnoli et al. 2012, 2014) and this can also be the case for companies from other industries that have expertise they can offer on a digital platform. For example, a provider of sensor technology for the industrial IoTs could offer its sensors together with applications for different Industrial IoT platforms instead of creating its own integration platform for the sensor data.

We label the choice of creating a digital platform versus joining a platform ecosystem the **make or join decision**. This is a reference to the make or buy decision which describes the assessment whether to build a product in-house or to buy it from a supplier (Walker/Weber 1984). In IS research, the make or buy decision has been discussed for outsourcing. In outsourcing, the question is whether a piece of software should be developed in-house or outsourced to IT service providers (Ang/Straub 1998). Similar to the make or buy decision, the make or join decision for digital platforms requires an assessment whether to build something—the digital platform—or to use something that others provide. But in the case of digital platforms, using another provider's digital platform does not require buying the platform but joining the ecosystem. Similar to buying software, that is, outsourcing the development task, joining a digital platform ecosystem is typically associated with costs. Even if some ecosystems might be free to join, they claim a share of the revenue that third-party developers generate on the digital platform.

While we did not directly study the make or join decision for traditional companies, our case studies on the challenges of implementing digital platforms reveal several factors that suggest either the make or the join decision (Table 49).

Dimension	Factors that support a *make* decision	Factors that support a *join* decision
Market size	▪ Large markets or possibility to address many niches simultaneously	▪ Small, niche markets
Existing partners and customers	▪ Existing ecosystem of partners that can be onboarded on the digital platform ▪ Existing customers that are targeted with the digital platform ecosystem	▪ No partners yet or existing partners that will be difficult to onboard on the digital platform ▪ No existing customers
Specificity of expertise	▪ Expertise relevant for a broad range of partners and customers	▪ Niche expertise
Competition	▪ No dominant digital platform on the market ▪ No "red ocean" of competing digital platforms	▪ Already a dominant digital platform on the market ▪ "Red ocean" of competing digital platforms
Relevance of applications	▪ Killer apps available that are crucial for customers' business	▪ Apps that only play subordinate role or customers' business

Table 49. The Make or Join Decision in Digital Platforms

First, the addressable market size is an important factor for the make or join decision. The larger the market, the easier it will be to reach critical mass. If there is only a small, niche market it could be more promising to join a digital platform ecosystem that has more general approach and thus addresses a larger market—if such a platform exists. If no such platform exists, a traditional approach to address the niche market with a dedicated software product could be the best way. Second, an existing partner network and existing customers that can be included in the digital platform ecosystem favor the make decision. Existing partners can be onboarded on the digital platform and the customers that already have a relationship with the platform owner will likely join. One of our interview partners from a traditional banking company illustrated:

> *"We have critical mass already. […] compared to start-ups, something like the Solaris Bank who were also offering banking as a service to start-ups. But their problem is that they can only offer a backend but they cannot offer customers. On our platform we have several million customers. The thing is that for our platform the external developers will be able to access […] all our customers. […] So, from a development perspective there is a million or whatever pool of customers potentially who would be customers for the application."* (I70)

Third, the specificity of the traditional company's expertise is of relevance. The more specific the expertise is the less suitable is an approach with a digital platform that aims at distributing that expertise horizontally. It could be more promising to join a platform ecosystem and offer a vertical use case based on the specific domain expertise the traditional company can offer. Fourth, the competitive landscape is an important factor for the make or join decision. If there is a dominant platform already in the market, it will be difficult to compete given the indirect network effects the platform owner enjoys. It could be more promising to join the dominating platform. If many platforms already compete in the market ("red ocean"), it could also be difficult to provide another digital platform. This is the case in the market for Industrial IoT platforms where numerous providers offer different digital platforms. One interview partner illustrated:

> *"[…] there are platforms like sand by the sea. If you go to the customer and you use the word platform, then most say: Please leave immediately, I can't, I really can't hear this [word] anymore."* (I113)

Fifth, the relevance of the applications that will be offered on the digital platform is important. If these will be “killer apps”, that is, applications that are of crucial importance for customers (Evans et al. 2006), it is easier to build a digital platform around that unique selling point. If the applications will serve subordinate purposes at the customers’ it will be more difficult to establish a successful digital platform.

Taken together, these factors allow for a more fine-grained evaluation of the make or join decision. Assessing the factors helps to understand whether a new digital platform will be able to reach critical mass and contributes to our understanding on how barriers to reach critical mass in general (Evans 2009; Evans/Schmalensee 2010).

If the decision is to join an existing digital platform ecosystem, this will also yield challenges for the traditional customers. Depending on the role they play in the ecosystem they join, they might lose the direct access to the customers because they consume applications via the platform. By joining other digital platform ecosystems, traditional companies furthermore become dependent on the platform owner. If it is possible to multihome, that is, to join several ecosystems in parallel, this would reduce the companies’ dependency on one platform (Armstrong/Wright 2007). Lastly, if several digital platform ecosystems have already been established in the market, traditional companies need to select one or several promising ecosystems to join. This is a difficult decision because seemingly less successful platforms can quickly overtake the leading platforms.

14 Limitations

The studies embedded in this thesis and, as a consequence, the thesis' findings as a whole are subject to several limitations. These limitations result from the research approach we followed, from the cases and data sources we selected, and from the scope we defined for this thesis.

For the majority of our studies we followed an interpretive, qualitative research approach, applying grounded theory methodology and action research. This research approach raises issues of potential biases and limited generalizability. First, as part of an interpretivist research approach, researchers interpret their observations of the phenomenon based on their own views and perspective. Both action research and grounded theory methodology are prone to this kind of **researcher bias**. In action research researchers are directly involved in changing the phenomenon under study, which can lead to a subjective bias in interpreting the data (Villiers 2005). Similarly, when applying grounded theory methodology, "The researcher's bias and subjectivity may influence conceptualization and interpretations." (Villiers 2005). When conducting our case studies, we were aware of that bias and used constant comparison between different data slices as well as between data and theory to account for the bias and to avoid forcing of preconceptions on the data (Strauss/Corbin 1990). We furthermore collected several viewpoints on the phenomena we analyzed (Strauss/Corbin 1990). For example, when studying how the platform owner of a cloud platform in the enterprise software industry captured value, we interviewed employees of the platform owner organization across different levels of hierarchy and we also interviewed ecosystem partners who were affected by the value capture mechanisms the platform owner applied (see P3). We also engaged in triangulation, that is, we collected data from various sources to create a better understanding of the phenomenon (Begley 1996; Strauss/Corbin 1990). For example, we enhanced our study on the ERP vendors shift from product platform to platform ecosystem with comprehensive secondary data such as news entries from tech blogs, participation in partner workshops, company presentations, and videos from developer conferences (see P7).

Second, **generalizability** is an issue inherent to qualitative research approaches such as case studies (Yin 2014). Generalizability gets even more challenging when these studies cover events over time with a process perspective (Van de Ven/Huber 1990). While we accept a certain degree of idiosyncrasy of our findings given the interpretivist approach we took on, we still aim at generalizing from our results wherever possible (Gioia et al. 2013). In our studies on the ERP vendors' cloud platform (e.g., P6 and P7), we discuss generalizability of our findings based on dimensions such as market characteristics or type of product. Discussing generalizability in such settings requires a context-sensitive approach (Davison/Martinsons 2016; Hong et al. 2014) because findings can be generalized easier in similar contexts.

Further limitations relate to the cases and data we selected. First, a large part of our results builds **on only one case of a digital platform** in the enterprise software industry (see P3, P5, P6 and P7). While we compared our findings to other digital platforms as part of a multiple case study (see P8), we still derive the most in-depth findings from a single case. Given the scope of this thesis, we prioritized an in-depth understanding of one platform as compared to a broader, high-level understanding of more platforms. Second, we relied on interviews as primary data source. Interview partners are subject to bias as well, such as the **retrospective reporting bias** (Eisenhardt/Graebner 2007). This bias is of particular relevance for longitudinal studies where interview partners report earlier events. Such a bias can be alleviated by interviewing different people within a digital platform ecosystem across different levels of hierarchy and even from different organizations. Third, as our analyses captured rather **early phases of platform ecosystems**, the long-term success of these digital platform projects is not guaranteed. We are not able to rule out that some of what we learned on governing value creation was only of short-term benefit. We accounted for that limitation by selecting successful traditional companies that had the resources to put sufficient time and effort into the platform project and by evaluating the success of the platform ecosystems early on as part of the qualitative case analysis.

Furthermore, the scope of this thesis required to focus on specific research questions with regard to value creation in digital platform ecosystems. We took on a **perspective of platform governance** and had to renounce further, similarly comprehensive and complex areas such as the technical design of digital platforms (Tiwana 2014). To address this issue, we make our scope clear in the studies and we highlight how extending the scope could contribute to our findings. For example, we study how traditional companies can govern digital platform ecosystems (P8) rather than what technologies they should use and how the architecture looks like. We also focus on the **platform owner's perspective** in the majority of our studies apart from P5 where we take on the perspective of ecosystem partners. While we conducted interviews with third-party developers and partners in all our studies, the purpose was mostly to validate results from the owner's perspective, and not to take on a new perspective on the phenomenon.

15 Implications

The findings of this thesis have implications for both theory and practice. Through the combination of research methods such as grounded theory methodology and context-sensitive theorizing, we provide rich theoretical insights that also entail guidance for practice (Hong et al. 2014, 112; Weber 2003).

15.1 Implications for Theory

With our findings, we aim to contribute to three distinct streams of research. First and foremost, we add to literature on **platform governance**. By exploring governance approaches of traditional companies that shift toward a platform ecosystem strategy, we get a more nuanced view on platform governance. Based on this, we can revisit the tradeoffs discussed in literature on platform governance.

First, platform owners face the tradeoff between openness and control (Ghazawneh/Henfridsson 2013). We confirm that this is an important balancing act across the digital platform ecosystems we studied. With regard to openness, we show that it is particularly challenging for traditional companies to shift toward increased technological openness. Often, there is internal resistance to increased openness because employees feel threatened by potentially more innovative external third-party developers. This is a new aspect that contributes to the discussion on the optimal degree of openness (Benlian et al. 2015; Ondrus et al. 2015). With regard to control, we found that for traditional companies it is crucial to protect their core from any interference by malfunctioning third-party applications. This is a challenge because in domains such as the enterprise software industry, there is more interaction between the core system and peripheral add-ons as for example in the case of mobile phones. Once the core is protected, it is important to rather enable third-party developers to provide sufficient quality than enforcing strict control. This is why traditional companies implement partner programs in which close collaboration is possible. Formal control mechanisms are also used but rather as an addition to process control of collaboration that should ensure adherence to quality levels. With these insights, we contribute to literature on control in digital platform ecosystems (Goldbach/Benlian 2014, 2015a, 2015b; Goldbach/Kemper 2014; Manner et al. 2013a).

A second tradeoff discussed in literature on digital platforms is the one between providing incentives for third-party developers and capturing value from the ecosystem. We found that traditional companies can leverage their customer base to incentivize third-party developers to join the ecosystem. This requires to onboard customers on the platform, for example by bundling it with other products. For example, an equipment manufacturer can bundle the equipment it sells with a digital platform for additional services. We thus show that launch strategies for digital platforms are different for traditional companies compared to the ones discussed in literature for green field launches (Evans/Schmalensee 2010; Schirrmacher et al. 2017). With regard to capturing value, we discovered mechanisms such as absorption, co-selling, and verticalization that add to the straightforward value capture through revenue sharing (Tiwana 2014; Oh et al. 2015).

With regard to the tradeoff between ecosystem-wide versus individualized governance (Huber et al. 2017), we show that standardized ecosystem-wide governance often is a delusion in complex digital platform ecosystems. Customers with heterogeneous legacy IT landscapes and partners with insufficient skills to onboard the platform require individualized governance.

Taken together, we contribute to a more nuanced understanding of platform governance in contexts where digital platforms do not correspond to the standard. In digital platform ecosystems with high degrees of verticalization, blurring roles of third-party developers and customers, multi layers of actors, and an open hardware layer, other governance approaches are required than in a scalable ecosystem with homogeneous third-party developers. Thereby, contextualization is an important factor to enhance theory on platform governance.

We furthermore contribute to literature on **value co-creation and value capture** in digital platform ecosystems. First, we identified the importance of value capture as a distinctive mechanisms of value creation in digital platform ecosystem (Lepak et al. 2007; Priem 2007). Only with a comprehensive perspective on value creation, the sustainability of a platform-based business model can be evaluated. Even if platform owners might decide to refrain from capturing value to incentivize more actors to join, this can only be part of the launch strategy and not part of a sustainable long-term strategy. Second, our focus on traditional companies helps us to understand how value creation changes as part of the digital transformation of traditional companies. As digital platforms play an increasingly important role in digital transformation (Sebastian et al. 2017), it is crucial to understand how linear value chains evolve into value networks and how focal firms can remain in a good position to capture value.

Lastly, we highlight our contribution with regard to **capabilities** for digital platform ecosystems. First, we identified specific platform ecosystem capabilities, namely cloud-based modularization, open IT, ecosystem management, platform evangelism, and platform co-selling. With capabilities on the architecture level, we contribute to literature on architectural frames, modularity and standardization in digital platform ecosystems frames (Henfridsson et al. 2014; Tiwana et al. 2010; Thomas et al. 2014) and with capabilities on the governance layer we contribute to literature on control, boundary resources, and developer communities (Parker/Van Alstyne 2018; Nielsen/Aanestad 2006; Eaton et al. 2015; Karhu et al. 2018; Förderer et al. 2018b; Qiu et al. 2017). Second, we show how platform owners can develop these capabilities in the process of platform emergence. To do so, we applied the concept of dynamic capabilities to the context of digital platform ecosystems, contributing to an ongoing debate on dynamic capabilities required to benefit from digital platforms (Helfat/Raubitschek 2018; Teece 2018).

In sum, we bridge IS and management literature to contribute to a better understanding of value creation in digital platform ecosystems.

15.2 Implications for Practice

Our results can be applied to digital platform ecosystems in practice. Most of these results provide guidance for current and future platform owners.

For platform owners in general, we highlight the need to differentiate value co-creation and value capture when designing platform governance. This differentiation helps practitioners to not only focus on ecosystem growth through increasing adoption but also to think about a sustainable business model for a digital platform early on. Furthermore, the capabilities we identified as relevant to successfully establish platform ecosystems can help platform owners to identify deficiencies. Being aware of capabilities that are not yet sufficiently developed can spare platform owners an expensive failure.

With regard to traditional companies that shift toward a digital platform strategy, we first provide insights on how internal business units and core partners can be considered in a platform governance approach. This is crucial because traditional companies typically have established business units that are involved in the platform project as well as existing partners that could be the first to onboard a new digital platform as strategic partners. Focusing platform governance only on peripheral third-party developers could backfire if internal business units and strategic partners do not support the platform project. Second, we highlight the role of customers as developers in ecosystem of traditional companies. Acknowledging that a digital platform will not only provide the basis for scalable apps but also for individual use cases can significantly enhance the impact of the platform. Third, we describe the make or join decision, that is the decision whether traditional companies should develop a digital platform or join an existing ecosystem. We thereby make platform owners aware that a digital platform is not necessarily the perfect strategy and we provide criteria that platform owners can evaluate when they are facing the make or join decision.

With regard to nonprofit platform owners, we show how platform governance differs to commercial ecosystems. In particular, we provide suggestions on how nonprofit platform ecosystems can be designed in an open way while a certain degree of control remains possible. As an increasing number of digital platform ecosystems emerges in nonprofit settings, we think that our findings will gain importance for platform owners.

In addition to platform owners, we studied partners and how they reacted when a digital platform was introduced. While different strategies can be successful, we have shown that it is important for partners to engage with new technologies the platform owner offers early on and to reflect on how these technologies could impact their business model. Furthermore, it is important for partners to connect with other partners of the same ecosystems. Jointly, partners can have more impact when making demands for the platform owner to improve the digital platform. Other partners can also have complementary solutions so that joint business opportunities can be leveraged. In sum, we hope that our findings prove useful for actors that are involved in digital platform ecosystems.

16 Future Research

Throughout our studies on platform ecosystems, several issues for future research arose that we were not able to address within the scope of the publications embedded in this thesis. We hope that the issues laid out below can provide avenues for future research.

In-depth analysis of the make or join decision. One of the findings of our case studies on traditional companies was that it is challenging to establish flourishing digital platform ecosystems. An alternative could be to join existing ecosystems. While we briefly discussed this as "make or join decisions" in this thesis, we did not study the make or join decision empirically. We think it could be worthwhile to empirically compare companies in a specific market or industry that have either created a digital platform ecosystem or joined an existing one. This would first help to understand better the challenges of selecting and joining an existing ecosystem. Second, the comparison could yield insights on characteristics of traditional companies that are beneficial either for creating or for joining a platform ecosystem. The market for platforms in the industrial IoT could be of interest for such an analysis because many traditional companies from manufacturing industries are active in the industrial IoT market while also many startups try to enter the market with platform offerings (IoT Analytics 2015). To compare different approaches of traditional companies, several in-depth case studies could be conducted, or al larger number of cases could be compared with methods such as qualitative comparative analysis, in particular in its fuzzy-set version (fsQCA; Fiss 2007; Ragin 2009). Insights from such analyses would not only help traditional companies in practice but contribute to literature on the launch of digital platforms (Evans/Schmalensee 2010; Schirrmacher et al. 2017).

A third-party developers' perspective on platform governance. In the studies we conducted, we focus mostly on the platform owner's perspective (P2-P4, P6-P8) and in one publication on the partners', that is, the developers' perspective (P5). This is in line with much of the literature on digital platforms, as we noted in our literature review (P1) which also tends to take on the viewpoint of the platform owner. To get a more comprehensive understanding of platform governance and its impacts, it is worthwhile to also focus on the third-party developers' viewpoint (cf. Ceccagnoli et al. 2012). Judging from the results in our study on the partners in an ERP vendors digital platform ecosystem, it is thereby important to account for different types of third-party developers. This is relevant both on the organizational level and the individual level. On the organizational level, companies that develop third-party applications on a platform can differ with regard to numerous characteristics such as their former projects on the platform, their set of expertise and skill, or the strategic relevance the activities on the platform have for them. For the individual level, it is notable that, ultimately, individuals use the digital platforms even if they are part of a company that is the third-party developer in the digital platform ecosystem. In many cases, initiatives of individuals to promote a digital platform can be decisive for the adoption of a digital platform by the organization. This is illustrated by Salesforce: to push adoption of their digital platform among third-party developers, they apply gamification in the developer community. As part of Salesforce's Trailhead program, developers can explore "trails" to learn about the platform and to earn points and badges (Hawley-Craig 2017). This approach seems to work despite most developers being part of larger companies. Future research could explore how individual developers can be best attracted by digital platforms and how they then promote adoption in their organizations.

Licensing and intellectual property (IP). During our analyses licensing and managing IP came up several times as tools to capture value in digital platform ecosystems. Given the scope of this thesis, we did not put an emphasize on these tools. Previous literature has found that modularizing IP in digital platform ecosystem can be beneficial for the platform owner's value capture (Waltl 2013) but needs to be managed carefully (Henkel et al. 2013). Others have discussed the optimal duration of IP protection in digital platform ecosystems (Parker et al. 2017). But also for ecosystem partners, keeping IP rights on their products is important for their success in the ecosystem (Ceccagnoli et al. 2012). At the same time, open source technologies such as Cloudfoundry or Kubernetes gain importance in digital platform ecosystems, making IP protection more difficult. Identifying the optimal approach to managing IP, selecting open source technologies, and appropriating value through licensing is thus a challenging endeavor for platform owners that yields interesting questions for IS research.

Competition, market dominance of U.S.-based companies, and regulation. The dynamics in platform-based markets tend to produce market structures with monopolistic or at least oligopolistic tendencies (Parker/Van Alstyne 2005; Böhm et al. 2018). Indirect network effects make established players more attractive for third-party developers and customers the larger their ecosystem already is—making it difficult for market entrants to reach critical mass. Examples of markets with a monopolistic or oligopolistic structure cover the market for mobile phone applications which is dominated by Google and Apple, the market for video game consoles where Sony, Microsoft, and Nintendo have created an oligopoly, or the market for commercial operating systems which has been controlled by Microsoft and its Windows operating system. Strikingly, almost all relevant market leaders in the Western world are based in the U.S. (Clemons et al. 2019). As a result, value that is created in the European digital economy largely accrues to these U.S.-based companies. With the advancing digital transformation of traditional industries, "American domination of the net" (Clemons et al. 2019) threatens to expand to more and more industries, even those previously dominated by European manufacturers. This raises several issues for future research. First, it would be worthwhile to study if and how quasi-monopolists expand their dominance to adjacent markets (envelopment; Clemons 2019). Second, possible response strategies of incumbents should be analyzed. This could yield factors that help incumbents to protect their market share such as control of relevant information domains and control of the interface to the customer. Third, a related research question is when and how regulators should intervene to sanction harmful behavior of monopolists. For example, the European Commission has set up an expert group to monitor the digital platform economy which conducts analyzes to ultimately inform regulatory action for the digital platform economy (European Commission 2018).

Non-monetary value creation and societal impact of digital platforms. In our studies, we focused mainly on how platform owners can create value with digital platforms. This is an important perspective, because digital platforms are becoming more and more central for the economy as a whole. But digital platforms have more potential than creating value for their owners. Future research could look into what stakeholder groups also benefit from digital platforms and how this benefit can be maximized. Beyond the actors involved directly in the ecosystem, also local communities and the society as a whole should be considered as recipient of value (Priem et al. 2019). Thereby, value needs to be understood in a broader way than just monetary in order to capture societal benefits. This broader perspective on value creation with digital platforms raises also the question what impact digital platforms can have for developing countries. Recently, the literature stream "Digital Platforms for Development" has emerged, as for example in 2019's conference of the IFIP Working Group 9.4 on social implications of computers in developing countries (IFIP WG 9.4 2019). For example, digital platforms can help to improve mobility in cities in developing countries where public transportation offerings remain limited (Gomez-Morantes et al. 2019). We hope that our work on digital platforms and first insights on platform governance for nonprofit platform ecosystems proves helpful for studying the societal impact of digital platforms.

17 Conclusion

Digital platforms gain importance across industries. The goal of this thesis was therefore to improve our empirical understanding of how platform owners can govern digital platform ecosystems. We first identified concepts of platform governance from literature and then conducted several qualitative case studies. Thereby, we focused on traditional companies that are shifting toward a digital platform strategy. We found that the situation of traditional companies differs from those of digital newcomers that implement digital platforms on the green field. In particular, we identify verticalization, blurring roles, a multilayered ecosystem, and an open hardware and data layer as factors that make platform governance more challenging for traditional companies. Our findings on how to apply governance across different layers, how to consider customers as developers, and how to develop the capabilities required to do all this help companies to successfully establish digital platform ecosystems. These results thereby contribute to ongoing debates in IS and management research on how to design and govern digital platform ecosystems. We hope that our results spark further research on digital platforms and platform governance.

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Appendix

Appendix A: Criteria for Interpretive Field Studies

Principle	Description by Klein/Myers (1999)	Illustrations from this thesis
The Fundamental Principle of the Hermeneutic Circle	"This principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form."	To understand our case companies' digital platform strategy, we had to iterate bottom-up and top-down approaches to interpret our data. For example, interview data included many insights on smaller parts of the strategy while secondary data such as presentations included the overall vision.
The Principle of Contextualization	"Requires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged."	The shift towards a digital platform strategy was triggered by contextual factors such as the advance of cloud computing technology and the activities of competitors. In the case synopsis section, we illustrate this background.
The Principle of Interaction Between the Researchers and the Subjects	"Requires critical reflection on how the research materials (or "data") were socially constructed through the interaction between the researchers and participants."	Our primary data source are interviews, in which interactions with the interviewees are key. The quotes illustrate that the interviewees interpretation of the situation differs—for example in how far they evaluate a platform ecosystem strategy as crucial for ERPcorp's future.
The Principle of Abstraction and Generalization	"Requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action."	We abstract our findings from the data along the lines of theoretical frameworks on platform governance. Thus, we can show that changes in human action is actually required for continuous adaption of platform governance.
The Principle of Dialogical Reasoning	"Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings ('the story which the data tell') with subsequent cycles of revision."	As research team, we are experienced in the domain of digital platforms. We thus had a mental model of platform governance. In the course of our studies, we had to revise this conception, as we realized the importance of our case companies' history as starting point to develop a digital platform strategy.
The Principle of Multiple Interpretations	"Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. Similar to multiple witness accounts even if all tell it as they saw it."	In our data, we encountered multiple instances of different interpretations, in particular when we talked to platform owner, partners, and customers on a given concept. For example, some of ERPcorp's partners from the on-premises age saw the platform ecosystem strategy as threat to their business rather an as opportunity to reach new customers—which represented ERPcorp's rationale.
The Principle of Suspicion	"Requires sensitivity to possible 'biases' and systematic 'distortions' in the narratives collected from the participants."	We identified and considered some distortions in our interactions with participants. For example, interviewees sometimes were eager to present their companies in a good light.

Table 50. Principles for Interpretivist Field Studies by Klein/Myers (1999)

Appendix B: List of Interview Partners

Interview	Date	Role	Brief description
I1	05.02.2016	Product owner IoT	▪ Product owner of the platform's version for the Internet of Things market ▪ Part of the project team for more than 3 years
I2	02.06.2016	Chief product owner	▪ Chief product owner of the platform ▪ 10 years at the company
I3	02.06.2016	Product manager	▪ Former researcher on software platforms ▪ Focus on pricing and positioning of the platform in the market ▪ Part of the project team for one year
I4	02.06.2016	Vice president	▪ Technical and strategic lead for the platform ▪ 20 years at the company in different positions
I5	02.06.2016	Chief architect	▪ Coordination of development teams of the platform ▪ 10 years at the company in different positions
I6	10.06.2016	External partner	▪ Founder of start-up that provides extensions for SAP's ERP suite
I7	11.07.2016	Partner manager	▪ Governance of partners of the (platform) ▪ 15 years at company in different positions
I8	12.07.2016	Manager for partner certification	▪ Responsible for certification of all company partners ▪ 17 years at company and at certification department
		Product & partner governance	▪ Governance of partners of the (platform) ▪ 15 years at company in different positions
I9*	12.07.2016	Program & partner manager	▪ Technical partner management for partners that enhance the company's ecosystem ▪ 23 years at company, 10 years as program & partner manager
I10*	12.07.2016	Products & innovation – development	▪ Technical alliance manager for top-selling extension partner ▪ 24 years at company in different positions
		Products & innovation – development	▪ Technical alliance manager for top-selling extension partner ▪ 17 years at company in different positions
I11*	13.07.2016	Manager global licensing	▪ Negotiation of contracts with software partners ▪ Focus on intellectual property questions in partnerships
I12*	13.07.2016	Program director sales and services	▪ Former partner manager for strategic partners ▪ Responsible for sales and services cooperation
I13*	18.07.2016	Vice president for business development	▪ Manager of third-party solutions in the ecosystem ▪ Leader of a global team for business development
I14	21.07.2016	Chief partner expert	▪ Partner management for insurance solutions ▪ 20 years at company in different positions
I15*	25.07.2016	Senior director, ecosystem and channels	▪ Partner management for third-party extensions ▪ 15 years at company in different positions
I16*	26.07.2016	Product manager certification	▪ Responsible for the processing and release of partner solutions ▪ 10 years at company in different positions
I17	27.07.2016	Partner officer manager	▪ Coordination of all partner activities in the ecosystem ▪ 21 years at company in different positions
I18	27.07.2016	Product & partner governance	▪ Consultant for collaboration activities with partners ▪ 20 years at company, 10 years as partner manager
I19*	28.07.2016	Chief operations officer	▪ Reports outcomes of partner activities directly to management board ▪ 13 years at company in different positions
I20*	28.07.2016	Product manager	▪ Product manager for cloud platform ▪ Collaboration with partners and customers

Table 51. Interview Partners – ERP Vendor (* interview conducted by supervised student)

Interview	Date	Role	Brief description
I21*	29.07.2016	External partner	▪ Head of partner activities with SAP ▪ 10 years at company in positions related to SAP
I22*	01.08.2016	External partner	▪ Technical alliance manager for the partnership with SAP ▪ 25 years at company in different positions
I23	03.08.2016	External partner	▪ Business development in the EMEA region ▪ Responsible for partner activities with SAP
I24	09.08.2016	External partner	▪ Responsible for extensions for the SAP ERP suite ▪ 16 years at company, 8 years working with SAP
I25	03.02.2017	Software engineer	▪ Developer for applications and micro-services for SAP's cloud platform
I26	08.02.2017	Software engineer	▪ Developer for applications and micro-services for SAP's cloud platform
I27	16.02.2017	Software engineer	▪ Developer for applications and micro-services for SAP's cloud platform
I28	06.10.2017	Chief product owner	I2
I29	11.01.2018	Chief executive officer	▪ SAP consultancy and partner
I30	22.02.2018	Project manager	▪ Global IT consulting company, including SAP's portfolio
I31	22.02.2018	Chief executive officer	▪ SAP consultancy with focus on ecosystem strategy
I32	23.02.2018	Project manager	▪ SAP partner with focus on business intelligence
I33	23.03.2018	Chief executive officer	▪ SAP partner with focus on business intelligence
I34	15.03.2018	Chief executive officer	▪ Small partner focused on managed business applications
I35	21.03.2018	Project manager	▪ Multinational IT provider offering and enhancing the SAP product portfolio
I36	26.03.2018	SAP alliance manager	▪ Multinational IT provider offering and enhancing the SAP product portfolio
I37	22.03.2018	Project manager	▪ IT consultancy with focus on the insurance industry
I38	28.03.2018	Manager for SAP service offerings	▪ Global full stack IT provider offering and enhancing the SAP product portfolio
I39	24.04.2018	Project manager	▪ Multinational IT provider and consultancy with focus on the insurance industry
I40*	01.06.2018	Sales manager	▪ SAP consultancy with focus on logistics, finance and reporting and enterprise content management
I41*	07.06.2018	Managing director	▪ Global trade services including customs based on SAP ERP suite
I42*	06.07.2018	Senior consultant with focus on SAP	▪ IT consulting company with focus on banking and insurance
I43*	11.06.2018	Chief executive officer of small SAP partner company	▪ IT company for SAP project implementation, focus on forms and output management
I44	12.06.2018	SAP business development manager	▪ Nationwide telecommunications provider in Germany that is also involved in SAP implementation projects
I45	14.06.2018	Owner and chief executive officer	▪ SAP-consultancy with a technical background and a focus on new technologies
I46	14.06.2018	Product manager and lead solution architect SAP Cloud Platform	▪ 14 years of experience in leading positions at SAP ▪ Already involved in the Netweaver stack, an early predecessor of SAP Cloud Platform
I47	15.06.2018	Partner manager	▪ Consultant at one of the largest IT consultancies world wide ▪ 13 years at SAP as alliance manager, now partner manager at the IT consultancy
I48*	19.06.2018	Founder and CEO	▪ SAP consultancy with focus on business apps and mobile apps

Table 51. Continued (* interview conducted by supervised student)

Interview	Date	Role	Brief description
I49*	26.06.2018	Managing director sale	▪ SAP consultancy that does SAP implementation projects for over 20 years ▪ Conversion to S/4 HANA as new focus
I50	20.08.2018	Senior vice president partner innovation	▪ Senior Executive responsible for Partner and Ecosystem adoption of SAP's PaaS offering, HANA Cloud Platform ▪ 20 years of experience of the European and US Technology Industries
I51	27.08.2018	Founder and CEO	▪ Cloud company, offering CRM Sales and CPQ (Configure Price Quote) software for Manufacturing, High-Tech and B2B Service industries ▪ Offerings based on SAP technology stack
I52	10.09.2018	SAP service director	▪ ICT and communication provider for enterprise and government, located in Singapore
I53	24.09.2018	Product Owner SAP S/4HANA Cloud SDK	▪ For more than 5 years involved in SAP Cloud SDK project
I54	27.09.2018	Managing director sales	▪ 15 years of Sales experience in that company ▪ Specialist for CRM, Customer Experience (CX) and Commerce
I55	27.09.2018	SAP consultant	▪ Involved in large migration projects in hybrid cloud environments
I56	05.11.2018	Project manager	▪ Multinational IT provider and consultancy with focus on the insurance industry
I57	12.11.2018	Senior vice president, head of corporate IT	▪ Global manufacturing company with focus on compressor and hydraulics technology ▪ Use of SAP Cloud Platform for Service
I58	06.12.2018	Managing director	▪ Provider of services in strategy, consulting, digital, technology and operations ▪ Focus on enterprise customers ▪ SAP Cloud Platform used for HR solutions
I59	07.12.2018	Global managing director	▪ Provider of services in strategy, consulting, digital, technology and operations ▪ Focus on enterprise customers ▪ SAP Cloud Platform used for HR solutions
I60	12.12.2018	Executive	▪ SAP HR/Payroll specialist based in Pretoria, South Africa ▪ Use of SAP Cloud Platform for subsidiary NGO that protects elephants from poaching
I61	20.12.2018	Chief product owner	▪ Chief product owner of the platform ▪ 10 years at the company
		Senior vice president of platform ecosystem & e-channels	▪ Expert of partner and channel management ▪ 10 years of experience in different SVP roles
I62	22.01.2019	Head of Partner & Business Development	▪ Platform company with focus on industrial Internet of things, consortium of several machine and equipment manufacturers ▪ Competitor of SAP IoT offering
I63	24.01.2019	Vice president Internet of things	▪ Go-to-market and strategic partnerships in the context of SAP Leonardo IoT ▪ >30 years of experience at SAP
I64	28.01.2019	Partner manager SAP Cloud Platform	▪ 3 years of experience as partner management in the context of the SAP Cloud Platform ▪ > 20 years of experience in the SAP ecosystem
I65	29.01.2019	Business development DACH	▪ SAP partner company that provides web shop and marketplace functionality ▪ Partnership with SAP since October 2018

Table 51. Continued (* interview conducted by supervised student)

	Date	Role	Brief description
I66	04.02.2019	Partner manager SAP Cloud Platform	I64
I67	28.02.2019	Managing director	▪ Managing Director at consulting company that develops an application at a platform that competes with the SAP Cloud Platform ▪ Application has been launched in 2018
	28.02.2019	Developer	▪ Lead developer of an application at a platform that competes with the SAP Cloud Platform ▪ Experience with different cloud platforms
I68	01.03.2019	CIO	▪ CIO of parastatal company that uses the SAP Cloud Platform for custom apps
I69	19.03.2019	Product management and strategy SAP Cloud Platform	▪ Involved in communication with partners and customers and in the web site of the SAP Cloud Platform

Table 51. Continued (* interview conducted by supervised student)

Interview	Date	Role	Brief description
I70	06.07.2016	Project team member	▪ Architect head for digital transformation and innovation ▪ Several years of experience with projects in the context of innovation and openness of IT
I71	06.07.2016	Project team member	▪ Innovation manager with experience in open innovation at different companies ▪ First employee to push the open API idea
I72	06.07.2016	Project team member	▪ Lead digital solution architect ▪ Responsible for internal adherence to API standards
I73	06.07.2016	Member of related teams	▪ Technical specialist in the investment department ▪ Implementing the connection of IT services in the investment department and the open API
I74	06.07.2016	Third-party developer	▪ Experienced third-party developer ▪ 19 years of experience in web development
I75*	27.06.2016	Project team member	▪ Solution architect ▪ Product owner of internal API
I76*	03.08.2016	Third-party developer	▪ Junior third-party developer ▪ Some experience in Java applications
I77*	04.08.2016	Project manager	▪ Vice president of APIbank and project manager of the open API project ▪ Participation in various workshops on open innovation in the IT context
I78*	09.08.2016	Member of related teams	▪ Solution architect in the investment department ▪ Designing the connection of IT services in the investment department and the open API
I79*	12.08.2016	Project team member	▪ Product marketing and strategy ▪ Former researcher with a focus on innovation and open innovation in large companies
I80*	25.08.2016	External consultant	▪ Experienced external consultant with focus on open innovation projects ▪ Focus on operating mode with regard to the open API project

Table 52. Interview Partners – Banking Company (* interview conducted by supervised student)

Interview	Date	Role	Brief description
I81	03.02.2016	Platform architect	▪ 5 years of experience in the IoT platform project ▪ One of the lead architects
I82*	23.01.2017	Knowledge manage	▪ Interface between marketing and offering management for IoT platform
I83*	23.01.2017	Sales manager	▪ Experience with sales of digital platforms in two companies over 3 years
I84*	04.02.2017	Technical consultant	▪ 13 years of experience in the company ▪ Various roles related to the platform project
I85	22.02.2017	Platform architect	▪ Expert for text mining and machine learning as part of the IoT platform project
		Lead software architect	▪ 18 years of experience at the company ▪ Various roles related to the platform project
I86*	25.02.2017	Application developer	▪ 4 years of experience as consultant and application developer related to the IoT platform project

Table 53. Interview Partners – IT Company (* interview conducted by supervised student)

Interview	Date	Role	Brief description
I87*	03.04.2017	Head of division	▪ Head of service management ▪ 19 years of experience in various roles
I88*	17.07.2017	Head of division	▪ Connected tool program coordinator ▪ For one year at the current role and 7 years of experience in various roles
I89*	16.08.2017	Head of division	▪ Head of digital and customer facing applications ▪ For 4 years in current position and more than 20 years of experience in various roles
I90*	07.09.2017	Head of division	▪ Head of connected tool program ▪ For more than one year in the current role and 10 years of experience in various roles
I91	08.11.2017	Head of division	▪ Head of IT application software and member of IT leadership board ▪ Owner of IT cloud, SAP stack and various IT solutions ▪ For 2 years in current role, works in IT division for 4 years
I92*	09.11.2017	Head of division	▪ Head of IoT development ▪ Responsible for IoT technology integration in products ▪ Manages edge and connectivity and heads development of different customer facing applications
I93*	09.11.2017	Head of division	▪ Head of marketing and member of executive management team Central Europe ▪ For more than one year in the current role and 18 years of experience in various roles
I94*	09.11.2017	Project manager	▪ Project manager IoT platform stack ▪ Responsible for developing IoT platform and building required capabilities ▪ For one year in the current role
I95	20.11.2017	Executive member	▪ Chief information officer ▪ For 13 years in the current role
I96*	22.11.2017	Head of division	▪ Chief enterprise architect and member of IT leadership board ▪ For 2 years in the current role and 9 year of experience in various roles
I97*	24.11.2017	Segment manger	▪ Segment manager tools and accessories ▪ For 2 years in the current role and 16 years of experience in various roles

Table 54. Interview Partners – Tool Manufacturer (* interview conducted by supervised student)

Interview	Date	Role	Brief description
I98	27.04.2017	Product owner app platform	▪ Head of platform team ▪ 5 years of experience in app platform development and operations
I99*	09.05.2017	Application developer	▪ Software developer in app development team
I100*	16.05.2017	Application developer	▪ Technical responsible person in app development team ▪ Multiple years of experience from multiple app development projects
I101*	23.05.2017	Platform developer	▪ Head of platform programming team ▪ Multiple years of software development in platform context
I102*	23.05.2017	Application developer	▪ Team manager of app development team ▪ Multiple years of experience from multiple app development projects
I103*	30.05.2017	Technical consultant	▪ Project leader of project for restructuring aftersales of digital products in cars ▪ Experience from multiple roles in digital aftersales
I104*	06.06.2017	Sales manager	▪ Business responsible person for one app
I105*	13.06.2017	Application developer	▪ Technical responsible person for development of multiple apps
I106*	14.06.2017	Sales manager	▪ Team member of app store web application team
I107*	15.06.2017	Application developer	▪ Head of development team of onboard store app
I108*	22.06.2017	Platform strategist	▪ Strategist for digital product development
I109*	22.06.2017	Platform strategist	▪ Strategist for digital product development ▪ Former team member in platform team
I110*	22.06.2017	Sales manager	▪ Business responsible person for one app ▪ Multiple years of experience from digital product sales in automotive context
I111*	23.06.2017	Sales manager	▪ Responsible for web portal as additional touchpoint for in-car apps

Table 55. Interview Partners – Automotive Manufacturer (* interview conducted by supervised student)

Interview	Date	Role	Brief description
I112*	19.06.2018	Founder and managing director	▪ 6 years of experience within the startup as founder and managing director
I113*	21.06.2018	Managing director	▪ Responsible for sales, business development, project management, marketing and support ▪ With regard to the digital platform focus on sales and business development
I114*	10.07.2018	Head of project engineering	▪ Experienced in manufacturing execution systems from previous work at major manufacturer ▪ Former product owner of the digital platform
I115*	17.07.2018	Head of development	▪ Responsible for technical development of the digital platform ▪ One of the first employees in the company
I116*	18.07.2018	Product and project manager	▪ Involved in development of the digital platform as product
I117*	20.07.2018	Sales and partner manager	▪ Focus on sales and partner management in relation to the digital platform
I118*	25.07.2018	Founder and managing director	I112

Table 56. Interview Partners – Industrial IoT Startup (* interview conducted by supervised student)

#	Title of publication	No. of interviews	Interviews	
P2	Co-Creating Value Through Openness and Collaboration – An IT Platform for Open Banking	11	Banking company:	I70-I80
P3	The Platform Owner's Challenge to Capture Value – Insights from a Business-to-Business IT Platform	27	ERP vendor:	I1-I27
P5	Shifting to the Cloud – How SAP's Partners Cope with the Change	14	ERP vendor:	I27-I41
P6	Transforming Capabilities for Platform Ecosystems: The Case of Enterprise Software	32	ERP vendor:	I1-I32
P7	From Product Platforms to Platform Ecosystems: The Role of Customers as Developers in the Enterprise Software Industry	61	ERP vendor:	I1-I61
P8	How Traditional Companies Establish Platform Ecosystems through Multi-Layer Governance – A Cross-Industry Study	70	ERP vendor: Banking company: IT company: Tool manufacturer: Autom. manufacturer:	I1-I28 I70-I80 I81-I86 I87-I97 I98-I111

Table 57. Interviews in Publications

Appendix C: Literature Coding and Full List of Reviewed Articles (P1)

Omitted concept	Comment
Business model	merged with competitive strategy
Features and functionalities	merged with technical design
Information and transparency	merged with boundary resources
Decision rights	merged with roles
Resolve conflicts	merged with roles
Network effects	merged with pricing and revenue sharing
Data	merged with boundary resources

Table 58. Omitted Coding Constructs of Governance and Design of Platform Ecosystems

#	Article
1	**Anderson, E. G., Parker, G. G., & Tan, B.** (2014). Platform performance investment in the presence of network externalities. Information Systems Research, 25(1), 152-172.
2	**Armstrong, M.** (2006). Competition in Two-Sided Markets. RAND Journal of Economics, 37(3), 1-32.
3	**Armstrong, M., & Wright, J.** (2007). Two-sided markets, competitive bottlenecks and exclusive contracts. Economic Theory, 32, 353-380.
4	**Arnold, Y., Leimeister, J. M., & Krcmar, H.** (2003). CoPEP: A Development Process Model for Community Platforms for Cancer Patients. Community Platform Engineering Process (CoPEP).
5	**Avgerou, C., & Li, B.** (2013). Relational and institutional embeddedness of web-enabled entrepreneurial networks: Case studies of netrepreneurs in China. Information Systems Journal, 23(4), 329-350.
6	**Bakos, Y., & Katsamakas, E.** (2008). Design and Ownership of Two-Sided Networks: Implications for Internet Platforms. Journal of Management Information Systems, 25(2), 171-202.
7	**Baldwin, C. Y., & Woodard, C. J.** (2008). The Architecture of Platforms: A Unified View. Working Papers - Harvard Business School Division of Research, 1-3.
8	**Basole, R. C.** (2009). Structural Analysis and Visualization of Ecosystems: A Study of Mobile Device Platforms. Fifteenth Americas Conference on Information Systems, San Francisco, California.
9	**Basole, R. C., & Karla, J.** (2011). Entwicklung von Mobile-Platform-Ecosystem-Strukturen und -strategien. Wirtschaftsinformatik, 53, 301-311.
10	**Benlian, A., Hilkert, D., & Hess, T.** (2015). How open is this platform? The meaning and measurement of platform openness from the complementors' perspective. Journal of Information Technology, 30, 209–228.
11	**Bergvall-Kåreborn, B., & Howcroft, D.** (2014). Persistent problems and practices in information systems development: a study of mobile applications development and distribution. Information Systems Journal, 24(5), 425-444.
12	**Bianco, V. D., Myllarniemi, V., Komssi, M., & Raatikainen, M.** (2014). The role of platform boundary resources in software ecosystems: A case study. IEEE/IFIP Conference on Software Architecture.
13	**Bock, G.-W., Ahuja, M. K., Suh, A., & Yap, L. X.** (2015). Sustainability of a Virtual Community: Integrating Individual and Structural Dynamics. Journal of the Association for Information, 16(6), 418-447.
14	**Boudreau, K. J.** (2010). Open Platform Strategies and Innovation: Granting Access vs. Devolving Control. Management Science, 56(10), 1849-1872.
15	**Boudreau, K. J.** (2012). Let a thousand flowers bloom? An earlier look at large numbers of software 'apps' developers and patterns of innovation. Organization Science, 23(5), 1409-1427.
16	**Boudreau, K. J., & Hagiu, A.** (2008). Platform Rules: Multi-Sided Platforms as Regulators. Working Pa-pers - Harvard Business School Division of Re-search, 1-29.
17	**Bresnahan, T. F., & Greenstein, S.** (1999). Technological competition and the structure of the computer industry. The Journal of Industrial Economics, 47(1), 1-40.
18	**Brousseau, E., & Penard, T.** (2007). The Economics of Digital Business Models: A Framework for Analyzing the Economics of Platforms. Review of Network Economics, 6(2), 81-114.
19	**Bullinger, A., Rass, M., & Moeslein, K.** (2012). Towards Open Innovation in Health Care. 20th European Conference on Information Systems, Barcelona.
20	**Butler, B. S., Bateman, P. J., & Gray, P. H.** (2014). An Attraction-Selection-Attrition Theory of Online Community Size and Resilience. MIS Quarterly, 38(3), 699-728.
21	**Caillaud, B., & Jullien, B.** (2003). Chicken & Egg: Competition among Intermediation Service Providers. The RAND Journal of Economics, 34, 309-328.
22	**Ceccagnoli, M., Forman, C., Huang, P., & Wu, D. J.** (2012). Cocreation of Value in a Platform Ecosystem: The Case of Enterprise Software. MIS Quarterly, 36(1), 263-290.
23	**Ceccagnoli, M., Forman, C., Huang, P., & Wu, D. J.** (2014). Digital platforms. Communications of the ACM, 57(2), 38-39.
24	**Cenamor, J., Usero, B., & Fernández, Z.** (2013). The role of complementary products on platform adoption: Evidence from the video console market. Technovation, 33(12), 405-416.
25	**Claussen, J., Kretschmer, T., & Mayrhofer, P.** (2013). The Effects of Rewarding User Engagement: The Case of Facebook Apps. Information Systems Research, 24(1), 186-200.
26	**Cowen, T., & Gawer, A.** (2012). Competition in the Cloud: Unleashing investment and innovation within and across platforms. Communications & Strategies, 85(1), 45-62.
27	**Cusumano, M.** (2010). Technology strategy and management - The evolution of platform thinking. Communications of the ACM, 53(1), 32-32.
28	**Cusumano, M., & Gawer, A.** (2002). The elements of platform leadership. MIT Sloan Management Review, 31(1), 51-59.
29	**David, J., & Mann, A.** (2007). The Emergence of On-Demand Software Aggregators: Implications for Developers, Customers, and Software Companies. Thirteenth Americas Conference on Information Systems, Keystone, CO, USA.
30	**Dibia, V., & Wagner, C.** (2015). Success Within App Distribution Platforms: The Contribution of App Diversity and App Cohesivity. 48th Hawaii International Conference on System Sciences.

Table 59. Articles Part of the Literature Review

#	Article
31	**Eaton, B. D.** (2012). The Dynamics of Digital Platform Innovation: Unfolding the Paradox of Control and Generativity in Apple ' s iOS. (Dissertation), London School of Economics.
32	**Eaton, B. D.** (2015). Distributed Tuning of Boundary Resources: the Case of Apple's iOS Service System. MIS Quarterly, 39(1), 217-243.
33	**Economides, N., & Katsamakas, E.** (2006). Two-Sided Competition of Proprietary vs. Open Source Technology Platforms and the Implications for the Software Industry. Management Science, 52(7), 1057-1071.
34	**Economides, N., & Tåg, J.** (2012). Network neutrality on the Internet: A two-sided market analysis. Information Economics and Policy, 24(2), 91-104.
35	**Eisenmann, T. R., Parker, G., & Van Alstyne, M.** (2006). Strategies for Two-Sided Markets. Harvard Business Review.
36	**Eisenmann, T. R., Parker, G., & Van Alstyne, M.** (2009). Opening Platforms: How, When and Why? Working Papers -- Harvard Business School Division of Research, 1-27.
37	**Eisenmann, T. R., Parker, G., & Van Alstyne, M.** (2011). Platform envelopment. Strategic Management Journal, 32(12), 1270-1285.
38	**Eurich, M., Giessmann, A., Mettler, T., & Stanoevska-Slabeva, K.** (2011). Revenue Streams of Cloud-based Platforms: Current State and Future Directions. Seventeenth Americas Conference on Information Systems, Detroit, Michigan.
39	**Evans, D. S.** (2003). The antitrust economics of two-sided markets. SSRN.
40	**Evans, D. S.** (2012). Governing Bad Behavior by Users of Multi-sided Platforms. Berkeley Technology Law Journal, 2(27), 41-46.
41	**Evans, D. S., Hagiu, A., & Schmalensee, R.** (2006). Invisible Engines: How Software Platforms Drive Innovation and Transform Industries. Cambridge, MA: MIT Press.
42	**Evans, D. S., & Schmalensee, R.** (2010). Failure to Launch: Critical Mass in Platform Businesses. Review of Network Economics, 9(4).
43	**Fichman, R. G.** (2004). Real options and IT platform adoption: Implications for theory and practice. Information Systems Research, 15(2), 132-154.
44	**Gannamaneni, A., Ondrus, J., & Lyytinen, K.** (2015). A Post-failure Analysis of Mobile Payment Platforms. 48th Hawaii International Conference on System Sciences.
45	**Gawer, A.** (2009). Platforms, markets and innovation: An introduction. In A. Gawer (Ed.), Platforms, markets and innovation (pp. 1-16).
46	**Gawer, A.** (2014). Bridging differing perspectives on technological platforms: Toward an integrative framework. Research Policy, 43(7), 1239-1249.
47	**Gawer, A., & Cusumano, M. A.** (2014). Industry Platforms and Ecosystem Innovation. Journal of Product Innovation Management, 31(3), 417-433.
48	**Gawer, A., & Henderson, R.** (2007). Platform owner entry and innovation in complementary markets: Evidence from Intel. Journal of Economics and Management Strategy, 16(1), 1-34.
49	**Ghazawneh, A., & Henfridsson, O.** (2011). Micro-strategizing in platform ecosystems: a multiple case study. Thirty Second International Conference on Information Systems, Shanghai.
50	**Ghazawneh, A., & Henfridsson, O.** (2013). Balancing platform control and external contribution in third-party development: The boundary resources model. Information Systems Journal, 23, 173-192.
51	**Giessmann, A., Kyas, P., Tyrväinen, P., & Stanoevska, K.** (2014). Towards a better Understanding of the Dynamics of Platform as a Service Business Models. 47th Hawaii International Conference on System Sciences.
52	**Giessmann, A., & Stanoevska, K.** (2012). Platform as a Service - A Conjoint Study on Consumers' Preferences. Thirty Third International Conference on Information Systems, Orlando.
53	**Gnyawali, D. R., Fan, W., & Penner, J.** (2010). Competitive actions and dynamics in the digital age: An empirical investigation of social networking firms. Information Systems Research, 21(3), 594-613.
54	**Goldbach, T., & Benlian, A.** (2014). Mobile Application Quality and Platform Stickiness under Formal vs. Self-Control - Evidence from an Experimental Study. Thirty Fifth International Conference on Information Systems, Auckland.
55	**Goldbach, T., & Benlian, A.** (2015). How Informal Control Modes affect Developers' Trust in a Platform Vendor and Platform Stickiness a Platform Vendor and Platform Stickiness. Twelfth International Conference on Wirtschaftsinformatik, Osnabrück.
56	**Goldbach, T., & Kemper, V.** (2014). Should I Stay or Should I Go? The Effects of Control Mechanisms on App Develpers' Intention to Stick with a Platform. Twenty Second European Conference on Information Systems, Tel Aviv.
57	**Grover, V., & Kohli, R.** (2012). Cocreating IT Value: New Capabilities and Metrics for Multifirm Environments. MIS Quarterly, 36(1), 225-232.
58	**Hackney, R., Burn, J., & Salazar, A.** (2004). Strategies for value creation in electronic markets: Towards a framework for managing evolutionary change. Journal of Strategic Information Systems, 13(2), 91-103.
59	**Hagiu, A.** (2014). Strategic Decisions for Multisided Platforms. MIT Sloan Management Review, 55(2), 71-80.
60	**Hahn, C., Röher, D., & Zarnekow, R.** (2015). A value proposition-oriented typology of electronic marketplaces for B2B SaaS applications. Twentieth Americas Conference on Information Systems, Puerto Rico.
61	**Henningsson, S., & Hedman, J.** (2014). Transformation of digital ecosystems: The case of digital payments. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics).
62	**Homscheid, D., Kilian, T., & Schaarschmidt, M.** (2015). Offen versus geschlossen - Welchen Zusammenhang gibt es zwischen Apple iOS- und Android-App-Entwicklern? Twelfth International Conference on Wirtschaftsinformatik, Osnabrück.
63	**Huntgeburth, J., Blaschke, M., & Hauff, S.** (2015). Exploring Value Co-Creation in Cloud Ecosystems - A Revelatory Case Study. Twenty Third European Conference on Information Systems, Münster.
64	**Hurni, T., & Huber, T.** (2014). The Interplay of Power and Trust in Platform Ecosystems of the Enterprise Application Software Industry. Twenty Second European Conference on Information Systems, Tel Aviv.
65	**Kazan, E., & Damsgaard, J.** (2014). An Investigation of Digital Payment Platform Designs : a Comparative Study of Four Designs: A Comparative Study of Four European Solutions. Twenty Second European Conference on Information Systems, Tel Aviv.
66	**Koch, H., & Schultze, U.** (2011). Stuck in the Conflicted Middle: A Role-Theoretic Perspective on B2B E-Marketplaces. MIS Quarterly, 35(1), 123-146.
67	**Koh, T. K., & Fichman, M.** (2012). Multihoming Users' Preferences for Two-Sided Exchange Networks. MIS Quarterly, 2(3), 977-996.
68	**Kude, T., Dibbern, J., & Heinzl, A.** (2012). Why do complementors participate an analysis of partnership networks in the enterprise software industry. IEEE Transactions on Engineering Management, 59(2), 250-265.

Table 59. Continued

#	Article
69	**Kuebel, H., & Hanner, N.** (2015). An Expert View on the Role of Complementary Assets for the Adoption of Smart Home Platforms. Nineteenth Pacific Asia Conference on Information Systems, Singapore.
70	**Kuk, G., & Janssen, M.** (2013). Assembling infrastructures and business models for service design and innovation. Information Systems Journal, 23(5), 445-469.
71	**Lin, M., Li, S., & Whinston, A. B.** (2011). Innovation and Price Competition in a Two-Sided Market. Journal of Management Information Systems, 28(2), 171-202.
72	**Lindgren, R., Eriksson, O., & Lyytinen, K.** (2015). Managing identity tensions during mobile ecosystem evolution. Journal of Information Technology, 1-16.
73	**Liu, C. Z., Au, Y. A., & Choi, H. S.** (2014). Effects of Freemium Strategy in the Mobile App Market: An Empirical Study of Google Play. Journal of Management Information Systems, 31(3), 326–354.
74	**Lusch, R. F., & Nambisan, S.** (2015). Service Innovation: A Service-Dominant-Logic perspective. MIS Quarterly, 39(1), 155-175.
75	**Manner, J.** (2014). Steuerung plattformbasierter Servicemarktplätze. (Dissertation), Technische Universität München.
76	**Manner, J., Nienaber, D., & Schermann, M.** (2013). Six Principles for Governing Mobile Platforms. 11th International Conference on Wirtschaftsinformatik.
77	**Mantena, R., & Saha, R. L.** (2012). Co-opetition Between Differentiated Platforms in Two-Sided Markets. Journal of Management Information Systems, 29(2), 109-140.
78	**Markus, M. L., & Loebbecke, C.** (2013). Commoditized Digital Processes and Business Community Platforms: New Opportunities and Challenges for Digital Business Strategies. MIS Quarterly, 37(2), 649-653.
79	**Ondrus, J., Gannamaneni, A., & Lyytinen, K.** (2015). The impact of openness on the market potential of multi-sided platforms: a case study of mobile payment platforms. Journal of Information Technology, 30(3), 260-275.
80	**Parker, G. G., & Van Alstyne, M. W.** (2005). Two-Sided Network Effects: A Theory of Information Product Design. Management Science, 51(10), 1494-1504.
81	**Ponte, D.** (2015). Enabling an Open Data Ecosystem. Twenty-Third European Conference on Information Systems, Münster.
82	**Porch, C., Timbrell, G., & Rosemann, M.** (2015). Platforms: A Systematic Review of the Literature Using Algorithmic Historiography. Twenty-Third European Conference on Information Systems, Münster.
83	**Qiu, Y.** (2013). Institutional logics, indie software developers and platform governance. (Dissertation), R.H.Smith School of Business.
84	**Qiu, Y., Hann, I.-H., & Gopal, A.** (2013). From invisible hand to visible hand: platform governance and institutional logic of Mac indies. Thirty Fourth International Conference on Information Systems, Milan.
85	**Rafiq, A., Ågerfalkm, P. J., & Sjöström, J.** (2013). Boundary resources dependency in third-party development from the developer's perspective. Lecture Notes in Computer Science, 197-211.
86	**Rai, A., & Tang, X.** (2014). Coevolution Perspective for Future Research Information Technology-Enabled Business Models: A Conceptual Framework and a Coevolution Perspective for Future Research. Information Systems Research, 25(1), 1-14.
87	**Rickmann, T., Wenzel, S., & Fischbach, K.** (2014). Software Ecosystem Orchestration: The Perspective of Complementors. Twentieth Americas Conference on Information Systems, Savannah.
88	**Rochet, J.-C., & Tirole, J.** (2003). Two-Sided Markets. European Economic Association, 1(4), 990-1029.
89	**Sambamurthy, V., & Zmud, R. W.** (2000). Research Commentary: The Organizing Logic for an Enterprise's IT Activities in the Digital Era - A Prognosis of Practice and a Call for Research. Information Systems Research, 11(2), 105-114.
90	**Selander, L., Henfridsson, O., & Svahn, F.** (2013). Capability search and redeem across digital ecosystems. Journal of Information Technology, 28(3), 183-197.
91	**Shaw, D. R., & Holland, C. P.** (2010). Strategy, networks and systems in the global translation services market. Journal of Strategic Information Systems, 19(4), 242-256.
92	**Smedlund, A., & Faghankhani, H.** (2015). Platform Orchestration for Efficiency, Development and Innovation. Forty Eighth Hawaii International Conference on System Sciences.
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95	**Staykova, K., & Damsgaard, J.** (2015). A Typology of Multi-sided Platforms: The Core and the Periphery. Twenty Third European Conference on Information Systems, Münster.
96	**Suarez, F., & Cusumano, M. A.** (2009). The Role of Services in Platform Markets. In A. Gawer (Ed.), Platforms, markets and innovation.
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98	**Thomas, D. W. L., Autio, E., & Gann, D. M.** (2014). Architectural leverage: putting platforms in context. The Academy of Management Perspectives, 28(2), 198-219.
99	**Tiwana, A.** (2015). Evolutionary Competition in Platform Ecosystems. Information Systems Research, 18(1), 7047-7047.
100	**Tiwana, A., Konsynski, B., & Bush, A. A.** (2010). Platform evolution: Coevolution of platform architecture, governance, and environmental dynamics. Information Systems Research, 21(4), 675-687.
101	**Wareham, J., Fox, P. B., & Cano Giner, J. L.** (2015). Technology Ecosystem Governance. Organization Science, 25(4).
102	**Yaraghi, N., Du, A. Y., Sharman, R., Gopal, R. D., & Ramesh, R.** (2015). Health Information Exchange as a Multisided Platform: Adoption, Usage, and Practice Involvement in Service Co-Production. Information Systems Research, Advance online publication.
103	**Zhong, J., & Nieminen, M.** (2015). Resource-based co-innovation through platform ecosystem: experiences of mobile. Journal of Strategy and Management, 8(3), 283-298.

Table 59. Continued

Appendix D: Evaluation of Criteria for Action Design Research (P4)

Principle	Description	Evaluation
Principle of the Researcher–Client Agreement	This principle ensures that researchers and clients (i.e. the practitioners) agree on conducting an action research study and on a common goal.	Researcher and practitioners agreed that a cyclical action research approach was suitable due to the criticality of the situation. The project goal and project responsibility were specified explicitly.
Principle of the Cyclical Process Model	This principle fosters an action research study's rigor by ensuring that all five phases of an action research process are conducted systematically.	As described in the results section, our study comprised two action research cycles following Susman et al. (2012).
Principle of Theory	An action research study has to be linked to existing theory in order to be of scientific relevance.	Our study builds on and contributes to literature on co-creation of value through platform ecosystems as well as to literature on IT-enabled collaboration.
Principle of Change through Action	This principle ensures that actions are taken within the scope of the action research study that contribute to solving the diagnosed problem.	In our study, we implemented governance mechanisms to derive a suitable governance strategy for an information platform ecosystem. The effects of these actions were documented and evaluated based on performance indicators of the platform as well as insights from interviews, workshops, and surveys with information providers.
Principle of Learning through Reflection	To ensure an action research study's relevance, this principle highlights that insights gained from the specific case need to be generalized in order to be applicable in other contexts as part of a reflection process.	In our study, researchers and clients together discussed the learnings based on the evaluated results. By linking these insights to the theory of co-creation of value in platform ecosystems in the discussion section, we generalize the findings of our study.

Table 60. Evaluation of the Five Principles of Action Research Studies by Davison et al. (2004)

Appendix E: Data and Coding Scheme (P6)

IS-Corp (20 interviews; 21 interview partners)	
Interview partners ▪ High level managers responsible for the *IS-Corp* platform (e.g., project lead, chief architect, product owner) ▪ Employees that worked with the same software product before the introduction of the *IS-Corp* platform and could thus report on the changes inflicted by the platform ecosystem strategy ▪ Relatively new employees that had gathered experience in platform projects at other companies	*Exemplary interview questions* ▪ "What are the core features of the *IS-Corp* platform?" ▪ "What challenges arised in the process of implementing the *IS-Corp* platform?" ▪ "How did the interaction with partners change with the introduction of the *IS-Corp* platform?" ▪ "What practices needed to change when the *IS-Corp* platform was introduced? ▪ "What is *IS-Corp's* business model behind the platform?"
Partners (12 interviews)	
Interview partners High level counterparts of *IS-Corp* within eight different partner companies. These partner companies either offer complementary applications to the *IS-Corp* platform or consult other companies on how to develop and market such applications.	*Exemplary interview questions* ▪ "What is your company's motivation to contribute to the *IS-Corp* platform ecosystem?" ▪ "Can you describe the collaboration with *IS-Corp*?" ▪ "What resources does *IS-Corp* provide to support your development of complementary applications?" ▪ "What is your company's business model behind the collaboration with *IS-Corp*?"

Table 61. Details on Primary Data for Publication P6

Type of data	Material
Documentation of *IS-Corp's* established enterprise software solution (technical documents, FAQ documents, customer presentations, …)	5 documents (98 pages)
Documentation of *IS-Corp* platform (technical documents such as API documentation, FAQ documents, customer presentations)	122 documents (341 pages)
Videos from *IS-Corp* developer conferences with a focus on the *IS-Corp* platform	5 videos (2.5 hours)
IS-Corp's investor relations (annual and interim reports 2015-2017)	14 documents (924 pages)
Acquisitions and acquired partners (crunchbase data, partner websites and developer documentation)	6 documents (24 pages)
News and tech blog entries related to *IS-Corp*	155 blog entries

Table 62. Details on Secondary Data for Publication P6

Interview statement and open coded sections		**Sub-categories** linked to open coded sections	**Categories** *[Coding family element]*
"The development model and development standards we provide is well established and provides, to a certain degree, a high level of security – in order to create marketable products.[1)] Accessibility is one of our [development] standards […] but of course also things such as maintenance, functional correction, compatibility to other [IS-Corp] products. These standard requirements, which partners have to adhere to – or argue why they don't, which needs to be approved by us – have emerged from long years of experience and they have proven their eligibility.[2)] A partner, who has less development experience, is not able to build a [development] process model as comprehensive as we did.[3)]" (*IS-Corp* chief partner expert)	1)	Development model / development cycle	IT integration *[initial stage]*
		Quality standards	Partner management *[initial stage]*
	2)	Quality standards	Partner management *[initial stage]*
		Approval process	Partner management *[initial stage]*
	3)	Developing partners	Partner management *[initial stage]*
"[…] so, we are more open with [the IS-Corp platform], and that is also the general trend that [IS-Corp] wants to go, because [we] know we cannot deliver top of the breed in every aspect, and there are a lot of strong open source communities developing simple things like a syntax highlighted editor […] but also complex things that allow you to do machine learning, NLP [non-linear programming] […].[1)] And [the platform] really offers you the capability to deploy such modules – sometimes written in node [node.js; JavaScript], sometimes written in Java.[2)] […] [the platform] is really opening up and goes away from the trend of just allowing [proprietary languages] to be the programming languages, and now offers JS [JavaScript], Java, C++. So the variety of programming languages also increases by moving to [the platform]. And that is the openness we provide.[3)]" (*IS-Corp* developer)	1)	Leveraging open source software	Open IT *[target stage]*
			From proprietary to open *[transition]*
		Limitations of *IS-Corp's* scope	Reasons for openness *[cause]*
	2)	Third-party modules	Cloud-based modularization *[target stage]*
		Boundary resources	Ecosystem management *[target stage]*
	3)	Compatibility to common languages and frameworks	Open IT *[target stage]*
			Compatibility *[steps]*
"[the IS-Corp platform] just gives you an entry point to your database, wherever that database is, but with web IDE as an entry point, it has this look and feel of a platform and dashboard where it can just deploy several services and leverage capabilities that the platform gives me[1)], like I don't know, weather service, authentication service, for my several applications and this services are called micro services and a lot of teams are actually developing just micro services that then developers can use in their applications.[2)] On top of that. And that is why it is a platform. […] There are some developed internally, the major ones, authentication services or [on memory database] in detail services but the platform itself is open enough to allow you to deploy and develop more micro services that come from third parties or just come from yourself.[3)] (external developer on the *IS-Corp* platform)	1)	Ease-of-use	Ecosystem management *[target stage]*
		Boundary resources	Ecosystem management *[target stage]*
	2)	Boundary resources	Ecosystem management *[target stage]*
		Micro-services & modularity	Cloud-based modularization *[target stage]*
		Developer community	Ecosystem management *[target stage]*
	3)	Accessibility of platform	Open IT *[target stage]*

Table 63. Illustration of the Coding Scheme for Publication P6

Appendix F: Coding Scheme (P7)

Illustratory data excerpts	Codes	Categories
"… The new model is built around a tier-based system […] Anyone interested in learning about the PartnerEdge advantage can explore the new framework commitment free.…" (excerpt from video on new partnership mode; June 2015)	Increase triability	Incentivize and support third-party developers
"The new solution [platform based on Cloudfoundry] is based on open technologies and provides more flexibility regarding technical possibilities. […]" (Vice president at SAP)	Use open source technologies	
"We work a lot with the SAP S/4HANA Cloud SDK, this basically is a library for Java projects, and at the same time it provides a delivery pipeline based on Jenkins and Docker containers. The whole topic of 'continuous everything" is already solved pretty smoothly [with the SDK]. (CEO of an SAP partner)	Provide SDK	
"We can get a benefit if we manage to sell thing on the app store. Only a small group of clients can enjoy whenever SI has implemented something, if they put it on the app store, any SAP client can download this application and can use it." (SAP service director at partner company)	Establish marketplace	
"[the partner] gives us 15% or a certain number of its sales. This is the classic Appstore model, according to the motto that you get something out there. But it also depends on the sales. And of course not to forget, the partner still pays us two and a half thousand euros per year for his account. […]" (Product manager at SAP)	Claim revenue share and access fee	Capture value from third-party developers
"The certifications are not for free, though, at the moment, we offer certifications on the cloud platform at cheaper rates" (Certification manager at SAP)	Claim certification fee	
"[we] bring in requirements for the S4 HANA Cloud SDK and these are then prioritized by SAP and we can see in the releases that our requirements have been implemented by SAP. […] This is not custom development, they ask for our feedback, they find it valuable and implement it" (Technology lead for SAP's cloud platform at a partner company)	Gather feedback for platform	Benefit from interaction
"In other words, SAP bought a third-party product in the US at the time that had the same functionality. They made the product part of their sales contracts... If they had not done that, then today we would be better off with [our cloud application]." (Sales manager of an SAP partner company)	Gain business knowledge	
"The major use cases for SAP Cloud Platform ABAP Environment are the development of new cloud apps in ABAP which are decoupled from the digital core. Of course, customers and partners see a chance to leverage their existing ABAP know how and want to reuse their existing on-premise assets in SAP Cloud Platform ABAP Environment." (SAP Blog, 2018)	Ensure backward compatibility	**Core category**: Enable customers as developers
"A lot of customers have come to us for SAP-to-SAP integration – typically connecting SuccessFactors with ERP. But a lot of our customers that don't have SAP wall-to-wall, they have a lot of third-party systems. So now they can use our cloud platform integration services to cover their entire landscape" (SAP senior director in video interview at TechEd 2018)	Provide third-party service connectors	
"[…]. And many customers have actually asked us to extend their SAP Cloud Platform solutions next to those workloads in the public clouds. And we got that message and we went generally available on AWS and beta on Azure in May this year. […] (Björn Goerke, CTO of SAP and President SAP Cloud Platform at TechEd 2017 in Las Vegas)	Support for different infrastructure providers	
„To start an implementation project, customers and partners can get themselves up to speed by going through our tutorials and the additional documentation. And then, they can basically start." (Product Owner of Platform SDK)	Provide learning material	
"So not only pure implementation partners but those who really accompa-ny the customer very early on in this process of the digital transformation. These partners then of course can refer to SAP's cloud platform along with Leonardo as the tools the customer actually needs to start the digital transformation." (SAP alliance manager at a large IT consultancy)	Increase platform functionality	
"But we are now adding a new consumption-based model for pricing and consuming all for one SKU. So, we are adding this consumption-based pricing model – one SKU, any service over a number of years. It gives more flexibility and agility on this new consumption-based pricing model, that's what we are really bringing to customers […]" (SAP manager, marketing of the cloud platform)	Claim partner and customer access fees	Capture value from customers and partners
This outcome-focused approach will eliminate the need to count individual users or other parties indirectly accessing SAP ERP in certain scenarios. This approach will ensure greater pricing transparency, predictability and consistency." (Indirect Access Whitepaper, July 2017)	Claim indirect access license fees	
"[…] We can lock them [customers] in, because we have a better integration to our ERP systems that customers use in there projects […] " (Product manager at SAP)	Lock in through development	
"We evaluate the reuse potential of customer projects. 99% of our projects are customer-specific. But if we identify reuse potential, we develop the solution in a modular way, keep the IP and reuse the modules. Internally, we have more than 200 modules that we can reuse." (Global managing director of IT consulting company)	Facilitate reusability of modules	Increase scalability across customers
"Attendees go to Sapphire Now to get the latest SAP product and strategy news, take part in SAP technical education sessions, meet with SAP partners who exhibit their products and services, and network with SAP executives, partners and customers." (Tech blog on SAPPIRE NOW)	Connect customers and partners	
"[…] we take the use case as a template, we might take the general architectural approach as a template, but the implementation is then really a new development with the aim of making this a product. […] Because the big effort is usually not to write the code but to have the use case and to understand the UI flow, how this should work. The code is then relatively easy." (Managing director at large IT consulting company)	Gain knowledge about use cases	

Figure 36. Coding Scheme for SAP's Platform Governance (adapted from Corley/Gioia 2004)

Appendix G: Coding Scheme (P8)

Interview statement and open coded sections	Sub-categories	Categories
"The development model and development standards we provide is well established and provides, to a certain degree, a high level of security – in order to create marketable products.[1] Accessibility is one of our [development] standards […] but of course also things such as maintenance, functional correction, compatibility to other [IS-Corp] products. These standard requirements, which partners have to adhere to – or argue why they don't, which needs to be approved by us – have emerged from long years of experience and they have proven their eligibility.[2]" (*IS-Corp* chief partner expert)	1) Standardization	Governance of core partners
	1) Boundary resources	
	2) Process control	
	2) Adherence to standards	
"[Establishing a platform] requires multiple silos to suddenly work together to develop a product that in the past was mainly hardware driven with embedded software included but still in a close hardware loop.[3] Now if you do it right, you add a data-driven business on top of it that follows to a certain extent different laws of implementation. And that makes it not really easy. Because suddenly you have hardware development cycles of multiple years vs. the highly agile and flexible cloud micro-service development.[4] […] one tool that is connected is a nice thing, but most of the use cases which really differentiate your offering requires a population [of tools] that is really connected. And getting that population equipped, considering hardware development cycles, product life cycles, adoption rate at customers, willingness to pay for it, hardware cost for connectivity, technology readiness, communication technology, a combination of cost for these communication technology – that are quite complex things to handle to actually define the right sequence of use cases for implementation so that you can define a good path through that jungle.[5]" (Product owner of *Tool-Group's* digital platform)	3) Collaboration of business units required	Governance of internal business units
	4) Alignment of development cycles	
	5) Preparing all products for platform	
	3) Multiple business units	Internal complexity

Table 64. Excerpt from Coding Scheme for P8

Appendix H: Published Articles in Original Format (P1-P5)

DESIGN AND GOVERNANCE OF PLATFORM ECOSYSTEMS – KEY CONCEPTS AND ISSUES FOR FUTURE RESEARCH

Research

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Abstract

The purpose of this paper is to give an overview of current research in IS on the design and governance of platform ecosystems. To this end, we conduct a literature review of relevant journals and conferences. We show that platform ecosystems have been analysed from two different perspectives: technology- and market-oriented. Thereby, most studies take on the viewpoint of the platform owner. Furthermore, we summarize key concepts on the design and governance of platform ecosystems that have been discussed in literature. As most relevant concepts we identify the definition of roles, pricing, boundary resources and openness. Based on this analysis, we derive issues for future research: the integration of market- and technology-oriented perspectives, an individual level of analysis to include complementors and end-users and the role of data as boundary resource in platform ecosystems. This paper contributes to the understanding of platform ecosystems in IS literature by structuring existing research with regard to different perspectives and concepts and by providing starting points for future work. In addition, it lays out which concepts practitioners need to consider when designing and governing platform ecosystems.

Keywords: Platform ecosystem, platform governance, boundary resource, literature review.

1 Introduction

“Proliferating digital platforms will be at the heart of tomorrow’s economy, and even government”, *The Economist* stated last year, referring to the dominance of platform ecosystems in today’s economy ("Something to stand on," 2014). In a broad sense, platforms can be defined as “foundational products, services, or technologies upon which additional complementary products, services or technologies can be developed” (Gawer, 2009b). The term platform ecosystem refers to the platform and all stakeholders interacting on the platform (Gawer & Cusumano, 2013). The dominance of platform ecosystems can be underlined by two numbers: six out of ten of the most valuable brands in the Interbrand index have platform-based business models ("Best Global Brands," 2014) including Apple and Google with their platform ecosystems dominating the market of smartphones. At the same time, all ten start-ups included in the list of the most trending start-ups in 2015 are, to a certain extent, based on platforms ("SpotRocket - Quantitative rankings of the world's hottest startups," 2015). The list includes for example Uber, Airbnb and Spotify as platforms connecting providers and consumers of services, and cloudera, a technological platform for processing big data.

Platform ecosystems need to attract and coordinate two or more different target groups also referred to as sides (Gawer, 2009b) – in most cases complementors and customers (Tiwana, 2014) – for example drivers and passengers in the case of Uber or developers and end-users in the case of an app store. The right design and a suitable governance concept are therefore key to orchestrating a successful platform ecosystem with all stakeholders (Smedlund & Faghankhani, 2015). As described by Tiwana, Konsynski, and Venkatraman (2013) in a special issue of the Journal of Management Information Systems on IT governance, new organizational forms enabled by IT such as platform ecosystems raise the questions “Who is governed?”, “What is governed?” and “How is it governed?”. Answering these questions in the right way is crucial for platform owners – especially in view of the fierce competition between ecosystems (Mantena & Saha, 2012). The owners of platform ecosystems constantly compete with others to gain market share both in the group of end-users and complementors. For example, Amazon is trying to gain ground in the market for mobile device applications which is dominated by Google and Apple. Amazon has just launched the program “underground” as an attempt to undermine the Google Play Store on Android as marketplace for mobile applications (Dillet, 2015).

Since the late 1990s, motivated by Microsoft’s unprecedented success with its operating system platform Windows, IS research tries to understand how successful platform ecosystems in the IT industry need to be designed and governed (Bakos, 1998; Messerschmitt & Szyperski, 2003; Selander, Henfridsson, & Svahn, 2010). Researchers analysed the technical requirements of software platforms (Baldwin & Woodard, 2008), characteristics of successful platforms (Tan, Pan, Lu, & Huang, 2015), optimal pricing for platform-based businesses (Lin, Li, & Whinston, 2011) and control mechanisms applied on platforms (Goldbach & Kemper, 2014). These aspects all relate to how platform ecosystems are designed and governed (Hein, Schreieck, Wiesche, & Krcmar, 2016; Tiwana, Konsynski, & Bush, 2010). However, the growing base of literature builds on different understandings of the term platform and different perspectives on platform ecosystems. While some researchers view platforms as an IT artefact (Baldwin & Woodard, 2008), others define it as an abstract construct that brings together different parties (Bakos & Katsamakas, 2008). As a result, findings on the design and governance of platform ecosystems lack conceptual consensus.

Several authors have already contributed to structuring the research field of platforms. Thomas, Autio, and Gann (2014) provide a comprehensive review from a management research point of view that not only includes platform ecosystems but also organizational platforms, product family platforms and market intermediaries. This analysis needs to be concretized for the IS field. Existing literature reviews on platform ecosystems in IS provide a focus on specific concepts related to platform ecosystems and do not provide an overview of concepts (Porch, Timbrell, & Rosemann, 2015; Smedlund & Faghankhani, 2015). In order to understand the role of design and governance in platform ecosystems, it is necessary to structure existing contributions based on their perspectives on platform ecosystems and the various concepts of design and governance they focus on. We thereby build on the framework developed by Tiwana et al. (2010) which is the first to integrate concepts of design and governance of platform ecosystems.

Towards this end, we conducted a literature review, condensing different perspectives on platform ecosystems in the first step. We determine that platform ecosystems have been analysed from two different perspectives: technology- and market-oriented. Thereby, most studies take on the viewpoint of the platform owner. In the second step, we present key concepts of the design and governance of platform ecosystems identified in literature. By discussing these concepts, our review reveals major open issues related to the design and governance of platform ecosystems: the integration of the two perspectives on platform ecosystems when discussing design and governance concepts, an individual level of analysis to consider characteristics of the actors in platform ecosystems and the role of data as boundary resource in platform ecosystems. Addressing these open issues will significantly contribute to our understanding of platform ecosystems and in particular of the key concepts of design and governance. The results will prove useful for practitioners that set up or run platform ecosystems and lack a structured overview of influencing factors on and within the platform ecosystem.

In the remainder of the paper, we first describe the process of literature search. Then, we present the results by structuring contributions according to different perspectives on platform ecosystems and by presenting the compiled concepts for the design and governance of platform ecosystems. Based on these findings, we discuss themes for future research.

2 Design of the Literature Review

In this review, we looked for publications that (a) focus on the platform ecosystem as unit of analysis and (b) derive explicit or implicit insights on how to design and govern platform ecosystems. Towards this end, we screened relevant outlets drawing on the guidelines by Webster and Watson (2002) and vom Brocke et al. (2009) and subsequently coded the studies with regard to their key results on platform ecosystems.

First, we conducted an all-field search (title, abstract, keywords, references) with the key word “platform” in the journals included in the Senior Scholars’ Basket of Journals of the Association for Information Systems. We screened the abstract of all 367 articles and identified 30 publications that matched both search criteria (a) and (b). If the match to our search criteria was unclear after reading the abstract, we read the full text to decide on the inclusion of the respective articles. Second, we performed a forward and backward search based on the publications gathered so far. This resulted in 40 additional articles from a variety of outlets. The sample includes books, such as the textbook “Platforms, Markets and Innovation” by Gawer (2009a), dissertations, e.g. from Qiu (2013), and articles from economic journals as long as they are related to the field of IS. Third, we extended our search to the leading IS conferences to include the most recent research topics. We focused on contributions published at the following conferences since 2013: International Conference on Information Systems (ICIS), European Conference on Information Systems (ECIS), Hawaii International Conference on System Sciences (HICSS), Americas’ Conference on Information Systems (AMCIS) and Wirtschaftsinformatik (WI). We restricted the search to title, abstract and keywords and excluded research-in-progress papers. Compared to the search in journals, we used the more specific search term “platform AND (ecosystem OR architecture OR governance OR control)” in order to end up with a manageable amount of hits. Again, the articles that resulted from the search were screened and selected according to the criteria defined above. This step yielded another 27 articles (Table 1). Finally, 6 articles were added to the sample based on suggestions by the reviewers[1], leading to a total of 103 articles.

We then coded the selected articles along three main coding dimensions, using an explorative coding process which was repeated iteratively to develop conclusive coding constructs for each of the categories (Lacity, Khan, Yan, & Willcocks, 2010). The first dimension represents the research method used in the articles. An overview of the predominant methods in a field of research helps to assess its maturity and to identify methods for future studies that complement existing research (Edmondson & McManus, 2007). The second dimension covers the articles' perspectives on platform ecosystems. This builds on previous literature reviews that have identified different streams of literature on platforms and helps to take a holistic perspective on platform ecosystems. The perspective also includes whether the studies focus on the platform owner, the complementors or the end-users. The third dimension comprises all concepts related to the design and governance of platform ecosystems that are discussed in the respective article. In addition to the main coding dimensions, we gathered information on the cases and examples used in the studies. By summarizing the insights along the coding dimensions, we can carve out the focal points of existing research and identify issues for future research.

Outlet		Search	Hits	Selected
Top journals	MISQ	*"platform"* in all fields	52	8
	JAIS		35	1
	ISR		59	8
	JMIS		76	3
	ISJ		12	4
	JIT		60	4
	EJIS		45	0
	JSIS		28	2
Top conferences	ICIS	*"platform AND (ecosystem OR architecture OR governance OR control)"* in title, abstract and keywords (published since 2013, no RIPs)	99	5
	ECIS		89	8
	AMCIS		150	6
	HICSS		33	4
	WI		21	4
Other	Other journals	Forward and backward search (for articles in top journals)	-	22
	Other conferences		-	2
	Dissertations		-	3
	Books / book chapters		-	6
	Other		-	7
		Total	**728**	**97**

Table 1. Summary of the literature search process. Six additional articles were added during the review process.

3 Research on Platform Ecosystems

In this part of the literature review, we summarize the insights from the selected and coded articles on platform ecosystems in IS following the three main coding dimensions: research method, perspectives on platform ecosystems, and concepts of design and governance of platform ecosystems.

[1] Articles suggested by the reviewers: Wareham, Fox, and Cano Giner (2015), Boudreau (2012), Tiwana (2015), Liu, Au, and Choi (2014), Selander, Henfridsson, and Svahn (2013), Kude, Dibbern, and Heinzl (2012)

3.1 Research Methods

Research interest in platforms in IS has constantly increased since the late 1990s (see Figure 1). First platform ecosystems such as IBM's hardware-based personal computer platform and especially Microsoft's tremendously successful software-based Windows platform attracted the interest of IS research. We analysed which research methods are used in the publications and found that the majority of contributions is based on qualitative research.

67 publications apply qualitative methods, whereof 36 are based on case studies. These cases mostly focus on the successful platform ecosystems of the last decades: Microsoft with its Windows ecosystem (Eurich, Giessmann, Mettler, & Stanoevska-Slabeva, 2011) as well as Google and Apple with their app store ecosystems (Manner, Nienaber, & Schermann, 2013). Another 25 studies apply various qualitative approaches such as theory building based on qualitative insights (Grover & Kohli, 2012) or expert interviews (Bergvall-Kåreborn & Howcroft, 2014). Quantitative insights are presented in 28 studies. Researchers apply data analysis (Basole & Karla, 2011), experiments (Goldbach & Benlian, 2014), surveys (Goldbach & Benlian, 2015), simulations (Butler, Bateman, & Gray, 2014) as well as mathematical models to understand the formation of prices (Bakos & Katsamakas, 2008) or to understand processes and relationships in platform ecosystems.

Plotting the data over time reveals that the share of quantitative research has increased over the last decade (see Figure 1). According to Edmondson and McManus (2007) who evaluate the maturity of research fields, this increase in the share of quantitative studies shows that the topic "platform" in IS is currently evolving from a nascent to an intermediate field of research.

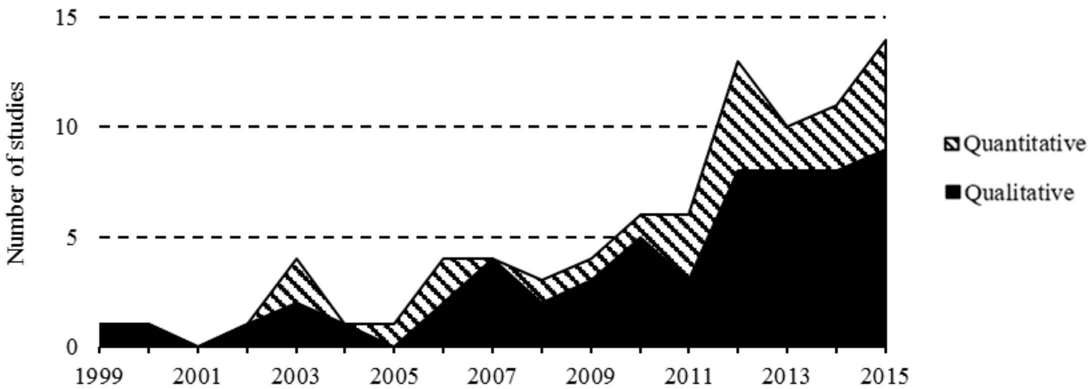

Figure 1. Number of quantitative and qualitative studies on platforms in IS over time (results from conference proceedings excluded, as the search was restricted to 2013-2015).

3.2 Perspectives on Platform Ecosystems

Our iterative coding process revealed two important dimensions along which studies take on different perspectives on platform ecosystems. First, studies have a different understanding of the platform ecosystem as unit of analysis. We therefore identify different perspectives on platform ecosystems by bringing together definitions and viewpoints from various studies. Second, studies focus on different stakeholders of the platform ecosystem, the platform owner, the complementors or the end-users. Both dimensions are discussed below. Regarding the understanding of the platform ecosystem, we identified more than 20 different definitions of the term "platform" referring to the core of the platform ecosystem. Based on these definitions and on existing attempts to cluster them, we derived two characteristics that can be used to differentiate platforms: technology- vs. market-oriented (Dibia & Wagner, 2015; Gawer, 2014; Thomas et al., 2014) and internal vs. external (Gawer, 2014; Porch et al., 2015). As we focus our literature review on platform ecosystems, we can assume that the underlying platforms are external, i.e. they bring together different actors to enable interactions that would not be possible without the platform (Ghazawneh & Henfridsson, 2011). We therefore focus on the characteristic technology- vs. market-oriented (see Table 2). The analysis suggests that the characteristic technology- vs. market-oriented is not mutually exclusive. An app store, for example, is a marketplace for apps, enabled by the underlying technology, i.e. the mobile device's operating system and its application programming interfaces (APIs). We therefore see technology- and market-oriented as two perspectives on platform ecosystems. To a certain extent, all platform ecosystems need underlying technology and will exhibit characteristics of a market.

According to the technology-oriented perspective, a platform is defined as "a set of stable components that supports variety and evolvability in a system by constraining the linkages among the other components" (Baldwin & Woodard, 2008). This definition comprises software platforms such as operating systems (e.g. Apple's iOS) and hardware platforms such as IT infrastructure or computing hardware (e.g. wireless networks) (Fichman, 2004). The purpose of technological platforms is to enable co-creation of value in the platform ecosystem by complementors, for example the creation of applications for an operating system platform. Accordingly, studies taking on a technology-perspective, focus on study variables that influence the intensity of the co-creation of value such as openness (Benlian, Hilkert, & Hess, 2015) or the provision of boundary resources (Bianco, Myllarniemi, Komssi, & Raatikainen, 2014).

Following the market-oriented perspective, platform ecosystems can be seen as "markets, where users' interactions with each other are subject to network effects and are facilitated by a common platform provided by one or more intermediaries" (Eisenmann, Parker, & Van Alstyne, 2011). This definition comprises e-commerce marketplaces where goods and services are exchanged (e.g. Ebay) as well as communities where information is exchanged (e.g. Facebook). Intermediaries bring together different parties to enable a transaction between these parties (Thomas et al., 2014). While Ebay connects buyers and sellers, Facebook connects providers and consumers of information. The market perspective on platform ecosystems is rooted in economics, where characteristics of multi-sided markets have been an ongoing research topic (Weyl, 2010). The purpose of market platforms is to match supply and demand on a digital marketplace. Therefore, studies taking on the market-oriented perspective focus on study variables such as the number of market sides (Economides & Tåg, 2012) or the competitive strategy (Armstrong, 2006) to understand price formation and the success of intermediaries.

	Technology-oriented perspective	Market-oriented perspective
Definition	"A set of stable components that supports variety and evolvability in a system by constraining the linkages among the other components" (Baldwin & Woodard, 2008)	"Markets, where users' interactions with each other are subject to network effects and are facilitated by a common platform provided by one or more intermediaries" (Eisenmann et al., 2011)
Sub-categories	Software platform, hardware platform	Marketplace, community
Examples	Google Play, Apple App Store, SAP HANA Cloud Platform, IBM Watson	Airbnb, Uber, Spotify, Facebook
Purpose	Co-creation of value, innovation	Matching of supply and demand, exchange of information
Selected independent variables	Perceived openness Boundary resources Availability of complementary products Control mode	Number of market sides Network effects Centrality Competitive strategy
Selected dependent variables	Number of third-party applications Rate of innovation Platform adoption Platform stickiness	Welfare Equilibrium price Platform adoption

Table 2. Summary of the technology- and market-oriented perspective on platform ecosystems.

The contributions considered in this literature review by the majority focus on one of the perspectives (Table 3). Over all outlets, only 10 studies explicitly cover both perspectives.

Article	**Perspective (Platform Ecosystem)**				**Perspective (Stakeholder)**		
	Technology		Market		Owner	Comple-mentor	End-user
	Soft-ware	Hard ware	Market-place	Commu-nity			
Top journals							
Anderson, Parker, and Tan (2014)	X		X		X		
Avgerou and Li (2013)			X	X		X	
Bakos and Katsamakas (2008)			X		X		
Benlian et al. (2015)	X					X	
Bergvall-Kåreborn and Howcroft (2014)	X					X	
Bock, Ahuja, Suh, and Yap (2015)				X	X		X
Butler et al. (2014)				X	X	X	
Ceccagnoli et al. (2012)	X					X	
Claussen, Kretschmer, and Mayrhofer (2013)	X		X		X	X	
Eaton (2015)	X				X	X	
Fichman (2004)	X				X		
Ghazawneh and Henfridsson (2013)	X				X		
Gnyawali, Fan, and Penner (2010)	X			X	X		
Grover and Kohli (2012)	X				X		
Hackney, Burn, and Salazar (2004)			X		X		
Koch and Schultze (2011)			X		X		
Koh and Fichman (2012)			X				X
Kuk and Janssen (2013)	X	X			X		
Lin et al. (2011)			X		X	X	
Lindgren, Eriksson, and Lyytinen (2015)	X					X	
Liu et al. (2014)	X		X			X	
Lusch and Nambisan (2015)	X				X	X	
Mantena and Saha (2012)			X		X		
Markus and Loebbecke (2013)				X	X		
Ondrus, Gannamaneni, and Lyytinen (2015)	X	X			X		
Rai and Tang (2014)	X				X		
Sambamurthy and Zmud (2000)	X				X		
Selander et al. (2013)	X					X	
Shaw and Holland (2010)			X		X		
Spagnoletti, Resca, and Lee (2015)	X			X	X	X	
Tiwana (2015)	X				X	X	
Tiwana et al. (2010)	X				X		
Yaraghi, Du, Sharman, Gopal, and Ramesh (2015)			X	X	X		X
Top conferences and others							
70 articles	40	3	22	2	60	17	7
Total	**61**	**5**	**34**	**9**	**85**	**31**	**10**

Table 3. Perspectives on platforms in IS research.

In addition to the different perspectives on platform ecosystems, we coded which stakeholder the studies in our review focus on – the platform owner, the complementor or the end-user (Table 3). The platform owner runs the platform and orchestrates the involved parties and processes on the platform. In most cases, the platform owner initiated the opening of the platform to enable the co-creation of value from third-parties (Ceccagnoli, Forman, Huang, & Wu, 2012) or to establish an exchange platform he can benefit from. In the example of the Apple App Store, Apple itself is the platform owner, running the App Store as integrated part of the operating system iOS. The complementor is an external party not directly related to the platform owner that contributes to the platform ecosystem (Eisenmann, Parker, & Van Alstyne, 2008). App developers who publish apps on the Apple App Store can therefore be referred to as complementors. The end-user or customer accesses the platform to consume a service available on the platform (Tiwana et al., 2010). The user of an Apple device is likely to visit the Apple App Store to download and install applications.

Of those articles, that exhibit a clear focus, 85 take the platform owner's perspective while only 31 consider the complementor, as for example Goldbach and Benlian (2015), and only 10 consider the end-user as for example Koh and Fichman (2012) (Table 3). This observation needs to be taken into account for the discussion of concepts for the design and governance of platform ecosystems as well as for the deduction of open issues for future research.

3.3 Design and Governance of Platform Ecosystems

Our results show that researchers' main interest has been to understand why and how platform ecosystems in the IT industry arise and become successful in order to identify the underlying mechanisms of successful platforms. Ultimately, guidelines how practitioners can design and govern successful platform ecosystems are derived (Benlian et al., 2015; Ondrus et al., 2015; Spagnoletti et al., 2015; Yaraghi et al., 2015). The success of platforms is usually measured by its size, e.g. number of users, complementors or complementary products or services (Ghazawneh & Henfridsson, 2013). For commercial platforms, size alone is not sufficient but has to be complemented by a profitable business model. While for example the success of the non-profit knowledge platform Wikipedia is measured by the number of articles, the success of an e-commerce platform such as Ebay also includes the revenue and profit Ebay generates as platform owner.

To contribute to our understanding of platform ecosystems, we aggregate insights on the design and governance of platform ecosystems across all studies identified as relevant in our literature search. Following Tiwana (2014), we differentiate insights on architecture and governance of platform ecosystems. However, we replace the term architecture by design, broadening the rather technical definition by Tiwana. He defines the architecture of a platform ecosystem as "a conceptual blueprint that describes how the ecosystem is partitioned into a relatively stable platform and a complementary set of apps that are encouraged to vary, and the design rules binding on both", whereas our understanding of the design of a platform ecosystem refers to a conceptual blueprint of the whole ecosystem, including the partners and processes interacting on the platform and that includes both the technology- and market-oriented perspective. Governance, the "partitioning of decision-making authority between platform owners and app developers, control mechanisms, and pricing and pie-sharing structures" (Tiwana, 2014), covers tactical decisions that impact the processes within the platform ecosystem. Governance is related to both the technology- and market-oriented perspective as it covers technological aspects such as providing APIs and market-related aspects such as setting prices.

We identified eight key concepts focusing on the design and governance of platform ecosystems (Table 4). Some concepts are relevant for both design and governance of platform ecosystems; some primarily affect either design or governance. Furthermore, as depicted in the last three columns of the table, the concepts have been discussed from a technology- or market-oriented perspective, in some cases both. In the remainder of this section we will briefly present these concepts.

The definition of **roles** within a platform ecosystem is an important factor of ecosystem design and covers for example the number of sides it connects (Gnyawali et al., 2010), the ownership regimes (Bakos & Katsamakas, 2008), the distribution of power which can be centralized or decentralized and the relationship to stakeholders of the platform ecosystem (Bullinger, Rass, & Moeslein, 2012). For example, a platform ecosystem for mobile payment must balance ownership and power of three sides in the ecosystem (banks, dealers and customers) and establish relationships to partner companies that can increase its popularity (as airlines and hotels do for credit cards). Roles in platform ecosystems are discussed from both a technology- and market-oriented perspective, but few studies have integrated the perspectives.

Pricing and revenue sharing has been studied as a governance mechanism in platform ecosystems. Pricing and revenue sharing refers to payment flows within the platform ecosystem and how they are distributed between the different stakeholders. These concepts can be used to support network effects and to overcome the chicken-and-egg problem in the initial phase of a platform ecosystem (Suarez & Cusumano, 2009). For example, Microsoft paid software developers to create first apps on the Windows phone platform in order to attract more users. Later on, the developers had to generate revenues by selling their apps to the end-users or displaying advertisements. Pricing and revenue sharing is mostly discussed from a market-oriented perspective. However, some studies take the technology-oriented perspective, for example when pricing for hardware components is analysed (Bresnahan & Greenstein, 1999).

Boundary resources are tools, regulations or other resources that are used to govern co-creation of value in platform ecosystems (Eaton, 2015). Most of the publications that cover boundary resources focus on APIs or software development kits (SDKs) that are used to facilitate co-creation of value. However, boundary resources can also stunt co-creation of value. For example, rigid regulations for the approval of complementary products or services on a platform may decrease the complementor's motivation (Eaton, 2015). A boundary resource that is gaining importance in practice is data which is provided by the users of a platform and can be made accessible for the complementors (Gawer, 2014). While data is mentioned as boundary resource in literature, its role is not yet analysed in detail. Boundary resources are analysed from a technology-oriented perspective as they impact the technical details of contributing to a platform but also complementors' motivation. Again, only few studies integrate a technology- and market-oriented view.

Openness refers to "to the easing of restrictions on the use, development and commercialization of a technology" (Boudreau, 2010). Following Boudreau (2010), a platform ecosystem can be opened by granting access to the platform or by partially giving up control over the platform. For example, Microsoft grants access to the Windows platform for application developers but stays in control, whereas in the Linux platform, the underlying technology has been made completely available to stakeholders (Ondrus et al., 2015). While choosing the right degree of openness is part of the design of a platform ecosystem, it can also be adjusted dynamically to govern the ecosystem as shown in case studies on Android and iOS (Homscheid, Kilian, & Schaarschmidt, 2015). So far, openness is mostly discussed from a technology-oriented perspective as it is closely related to how access is granted to technology. Few studies also consider the market-oriented perspective or both perspectives.

In addition to these concepts, we identified control, technical design, competitive strategy and trust as relevant concepts discussed by several authors. **Control**, in general, is used to "direct attention, motivate, and encourage organizational members to act according to organizational goals and objectives" (Wiesche, Schermann, & Krcmar, 2011) and IS play a key role to implement control mechanisms (Schermann, Wiesche, & Krcmar, 2012; Wiesche, Berwing, Schermann, & Krcmar, 2011). In platform ecosystems, control refers to how the platform owner governs the processes within his platform ecosystem and can be divided into formal control mechanisms (e.g. output control) and informal control mechanisms (e.g. clan control) (Tiwana, 2014). **Technical design** comprises the modular architecture of the platform (Tiwana et al., 2010), the definition of its interfaces and the compatibility to relevant systems. **Competitive strategy** describes whether competition, collaboration, or the mélange of both, co-opetition, is the most suitable strategy to establish a platform ecosystem among competing ones (Mantena & Saha, 2012). **Trust** as counterpart of power is a basic prerequisite for a platform ecosystem to succeed (Hurni & Huber, 2014). It is relevant for the relationship between platform owner and complementors as well as for the relationship between customers and the platform ecosystem as a whole. Similar to the concepts described above, only few studies integrate the technology- and market-oriented perspective when discussing control, technical design, competitive strategy and trust.

Concept	Aspects	No. of studies		
		technology-oriented	market-oriented	both
Roles	• Number of sides • Ownership • Distribution of power • Relationship to stakeholders	15	14	2
Pricing and revenue sharing	• Achieving network effects • Barriers to market entry • Subsidizing of one or more sides	8	16	3
Boundary resources	• Software tools (API, SDK) • Documentation • Data	14	7	2
Openness	• Granting access to technology • Giving up control over technology	13	3	2
Control	• Informal control mechanisms • Formal control mechanisms	12	1	2
Technical design	• Modularity • Interfaces • Compatibility	10	4	1
Competitive strategy	• Competition • Co-opetition, collaboration • Single vs. multihoming	1	5	1
Trust	• Relationship complementor – platform owner • Relationship end-user – platform	1	1	1

Table 4. Concepts of design and governance of platform ecosystems.

4 Central Issues for Future Research on Platform Ecosystems in IS

In this section, we discuss central issues for future research on the design and governance of platform ecosystems in IS based on the insights gained in the analysis of existing literature. We discuss three major issues: the integration of the different perspectives on platform ecosystems when analysing design and governance concepts, an individual level of analysis in platform ecosystems and the role of data as boundary resource in platform ecosystems. We suggest that future research on these issues will deepen our understanding of platform ecosystems and allow to derive recommendations for their implementation and management in practice.

4.1 Integrating Different Perspectives on Platform Ecosystems with Design and Governance Concepts

Future research can gain additional insights on how to design and govern ecosystems by integrating the technology- and market-oriented perspective on platform ecosystems. None of the platform-based businesses can be described with only one of the perspectives (Basole, 2009). An app store, for example, is a marketplace that matches demand for and supply of applications on mobile devices. At the same time, the app store is the platform owner's vehicle to co-create value on his technological platform, i.e. the operating system of the mobile devices. To understand such platform ecosystems that can be interpreted as two interlaced platforms – a technology and a market platform – the technology- and market-oriented perspectives have to be integrated. Existing literature rarely adapts an integrated view, as shown in our review.

All of the constructs related to the design and governance of platform ecosystems that we have identified in our literature review, can be viewed from a technology- and a market-oriented perspective. For example, providing boundary resources such as APIs or development tools is, on the one hand, a technological aspect of governance used to incentivize developers to contribute to a platform ecosystem. On the other hand, providing boundary resources will also impact the platform ecosystem as a marketplace by increasing the competition between developers. Similarly, the agreement on decision rights for the different stakeholders within the platform ecosystem is influenced by technology- and market-oriented considerations: decision rights for developers on a platform may include the tools and frameworks used but also the prices that can be set in the market.

First contributions integrate the different perspectives with regard to specific phenomena. For example, Claussen et al. (2013) discuss incentives for developers of Facebook apps while interpreting the Facebook app store as market and technological platform. Yet, many concepts related to the design and governance of platform ecosystems still need to be evaluated against the integrated view. Cusumano (2010) stated that “[w]ho wins and who loses these competitions is not simply a matter of who has the best technology or the first product. It is often who has the best platform strategy and the best ecosystem […].” In order to come up with the best strategy for a platform ecosystem, research and practitioners need to consider both the technology- and the market-oriented perspective.

In doing so, research should not only focus on case studies of successful platform ecosystems, as “successful […] platforms are the exception” (Hagiu, 2014). Insights from failed platform ecosystems can enhance the field and provide additional insights. Within multiple-case studies of successful and non-successful platform ecosystems, patterns for successful design and governance strategies could emerge. As a starting point, a case survey of existing case studies as described by Jurisch, Wolf, and Krcmar (2013) could provide valuable insights.

4.2 An Individual Level of Analysis for End-users and Complementors

Our review revealed that most studies focus on the platform owner, neglecting the perspective of the end-user or complementor. For example, Table 3 shows that no study with a technology-oriented perspective takes on the end-user perspective although the end-user is also affected by technological decisions of the platform owner. The complementor’s perspective, even though adapted by several more recent publications (Bergvall-Kåreborn & Howcroft, 2014; Goldbach & Benlian, 2015; Hurni & Huber, 2014), is based on an abstract representation of the complementor, its characteristics are not considered on an individual level of analysis. Bergvall-Kåreborn and Howcroft (2014) argue that complementors and end-users need to be seen as individuals because their different characteristics can impact the relationship they establish to the platform ecosystem. Including the complementors and end-users into the analysis, will also allow to discuss a bottom-up approach in the design and governance instead of interpreting it as a top-down approach only – a gap that has recently been shown by Constantinides and Barrett (2015).

A software developer from an open source community might be incentivized by open interfaces and the freedom to decide on the tools and frameworks to use. A start up, on the other hand, might focus on reliable, documented interfaces and adequate pricing and revenue sharing. Depending on which types of complementors a platform owner wants to attract, different design and governance concepts may prove useful. To understand the role of individual complementors and end-users, future research should take on an individual level of analysis. Experiments or simulations could generate insights detached from specific cases as for example in the experiment by Goldbach and Benlian (2014) who compare different control mechanisms in platform ecosystems. Similar to Schilling, Laumer, and Weitzel (2011) who evaluate the motivation of open source software developers depending on their personality, personality traits and more specific characteristics such as a complementor’s self-efficacy or goal setting could be evaluated. In doing, so it could be worthwhile to not only analyse current complementors and end-users of a platform but also complementors who failed with their product and end-users who have already turned their back on the platform ecosystem.

Complementors and end-users are not necessarily individuals. Especially in the case of business-to-business platform ecosystems, complementary products are created by and sold to companies. Instead of a large crowd of developers, the platform owner has to govern a group of partner companies. Some of them might be strategic partners that enhance the platform ecosystems value for customers significantly. With regard to the customer companies, a platform needs to provide firm-specific solutions that are still based on the same technological platform, a challenge that for example all ERP system providers are facing at the moment. Based on research on interfirm networks, the role of relationships and strategic partnerships could be a worthwhile area for future research.

4.3 Data as Boundary Resource in Platform Ecosystems

In our analysis of existing literature, we identified the concept of boundary resources as one of the most important governance mechanisms. At the same time, Gawer (2014) depicts the importance of data as boundary resource. However, no article explicitly analyses the role of data as boundary resource in platform ecosystems. In practice, many of today's platform ecosystems are fuelled by data. For example, Google and Facebook use the aggregated user data to sell personalized advertisements, attract developers by providing selected data streams via API (Gawer, 2014) and build additional services such as Google's real-time traffic information service based on movement data of Android users (Barth, 2009). As data is usually provided via APIs, it is also worthwhile to analyse how these interfaces define standards for data exchange and how these standards change over time. This might affect the optimal design and governance of platform ecosystems.

Data that is aggregated in a platform ecosystem can even be a threat. Developers can use the data aggregated by their own apps to strengthen its competitive position vis-à-vis the platform owner. For example, fitbit, a seller of fitness trackers, uses the data aggregated by its iOS and Android apps to establish its own ecosystem based on wearables – perhaps one reason why Apple and Google push their own fitness and health ecosystems Apple Health and Google Fit (Pressman, 2015). The way the data flow is handled in platform ecosystems is therefore an important aspect of platform governance, largely neglected in existing literature.

First publications have touched the topic of data in platform ecosystems in the context of open data (Ponte, 2015), wearables (Sun, Lou, Li, & Wang, 2015), and inter-organizational collaborations (van den Broek & Veenstra, 2015) but did not explicitly consider its role as boundary resource. A first step would be to evaluate how data is used to govern platform ecosystems in practice and to generalize the findings. This will enhance research on governance of platform ecosystems and address a topic that is highly relevant in practice.

5 Conclusion

In this paper, we summarized recent literature on platform ecosystems and derived open issues for further research based on the results. We analysed the methodology applied by the studies in our review, determined different perspectives research takes on platform ecosystems and condensed the key concepts of design and governance of platform ecosystems. In doing so, we identified three major issues for further research. First, we suggest to integrate the market- and technology-oriented perspective when discussing phenomena on platform ecosystems. This is in particular relevant for design and governance concepts such as boundary resources or openness that are implemented technically but impact the market-related processes on the platform. Second, we think that future research needs to integrate complementors and end-users into the analysis in addition to the platform owner. An individual level of analysis would further contribute to our understanding as each contributor and end-user is different. Third, we recommend to study data as boundary resource in more detail. Data has been mentioned in several contributions as boundary resource fuelling platform ecosystems and is highly relevant in practice.

By reviewing existing literature and deriving issues for future research, our study contributes to IS governance literature in several ways. First, we provide a holistic overview on research related to the design and governance of platform ecosystems. The overview integrates contributions that were previously not related due to a heterogeneous understanding of platforms and platform ecosystems. Thereby, we provide a unified foundation for future research on design and governance of platform ecosystems. Second, we summarize concepts related to the design and governance of platform ecosystems across all studies. In doing so, we identify the key challenges relevant for all platform ecosystems and reference the current state of research regarding these challenges. Third, we derive specific issues for future research that are rooted in existing research but show how our understanding of platform ecosystems and their governance can be enhanced. Finally, our study is relevant for practice by laying out which concepts practitioners need to consider when designing and governing a platform ecosystem. Currently, digital platforms spring up like mushrooms while others are withering and practitioners try to figure out how to bring them to success. The issues we identified will provide useful in practice and will further advance the applicability of the scientific findings on platform ecosystems.

The results of our study underlie several limitations. First, the literature search might not cover all relevant studies due to the choice of outlets and keywords. For example, alternative terms for the concept of platform ecosystems such as software ecosystem, partnership network, etc. might yield additional relevant articles. Second, the coding process we conducted simplifies the results of the studies to make them comparable. Similar concepts were merged to superordinate concepts, as summarized in Table 5 in the appendix. In the course of this process, some insights might have been lost and are not represented in our results. A greater level of detail within studies that focus on specific concepts might generate additional insights. Third, our twofold perspective on platforms in IS, market- and technology-oriented needs to be concretized with further cases from practice. While the perspectives are based on existing literature on platforms, we could not clarify all communalities and differences between the perspectives within the scope of this review. Fourth, the issues for future research that we derived from our results may be influenced by the authors perspective and the topic. Further open issues might therefore exist and can be discovered by future work.

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Appendix

Omitted concept	Comment
Business model	merged with competitive strategy
Features and functionalities	merged with technical design
Information and transparency	merged with boundary resources
Decision rights	merged with roles
Resolve conflicts	merged with roles
Network effects	merged with pricing and revenue sharing
Data	merged with boundary resources

Table 5. Omitted coding constructs of governance and design of platform ecosystems.

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HOW ESTABLISHED COMPANIES LEVERAGE IT PLATFORMS FOR VALUE CO-CREATION – INSIGHTS FROM BANKING

Research paper

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Abstract

Inspired by the success of digital-native companies such as Google or Salesforce, established companies such as car manufacturers, equipment manufacturers, or banks strive for value co-creation via open IT platforms. However, literature on value co-creation does not cater to the specific situation of established companies. Addressing this gap, we seek to improve our understanding of how established companies can co-create value through openness and collaboration with IT platforms. Based on an exploratory field study of a European bank that is introducing an IT platform, we show that openness and collaboration enable value co-creation while creating areas of conflict and potential benefit. For example, openness creates internal resistance and exposes technology while facilitating internal transparency and standardization. Collaboration entails conflicts with existing partners that are affected by the value co-creation strategy, but existing partners are also assets in incentivizing collaboration with third-party developers. Contributing to literature on value co-creation and openness of IT, we confirm that established companies can benefit from IT platforms but need to address specific areas of conflict and potential benefits related to balancing openness and control and governing collaboration. Our discussion provides first insights for established companies that consider implementing an IT platform strategy.

Keywords: IT platform, Multi-sided platform, Value co-creation, Established companies, Openness, Collaboration, Governance, Third-party developer, Digital business strategy, Exploratory case study.

1 Introduction

Information technology (IT) has enabled companies to create value in a purely virtual environment (Rai & Tang, 2014). Through these technologies, “digital-native” companies such as Google, Facebook or Salesforce offer digital services like mobile apps, communication and games or customer relationship management (CRM) to their customers. Those services are predominantly provided by third-party developers, i.e. actors that independently develop applications that are complementary extensions to the digital-native companies’ key offerings (Ceccagnoli, Forman, Huang, & Wu, 2014; Huntgeburth, Blaschke, & Hauff, 2015). The collaboration between the digital-native companies and the third-party developers enables co-creation of the digital services offered for customers. As value co-creation is enabled through the collaboration among different actors, it is only possible if access to company resources is given to the third-party developers (Tiwana, Konsynski, & Bush, 2010). Digital-native companies provide this access though openness of their IT systems, usually by designing IT platforms with open interfaces. Value co-creation through openness and collaboration has proven to be a promising path to success for many digital-native companies (see examples provided by Rai & Tang, 2014).

Triggered by the success of the digital-native companies, established companies in turn, strive for value co-creation through openness and collaboration. With the term “established”, we refer to companies whose key offering dates back to before the dotcom bubble (e.g., cars, TVs, washing machines) who are still active in this market. The goal of these companies is to enable open innovation through collaboration with third parties (Huff, Möslein, & Reichwald, 2013; Reichwald & Piller, 2006). For example, the car manufacturer BMW operates an IT platform “BMW Connected” that offers various digital in-car services. These services have been created in collaboration with numerous third-party developers who have been given access to the platform.

Established companies face particular challenges when they want to move the co-creation of digital services and as such the collaboration with their third-party developers on designated IT platforms because these companies already have an established IT landscape that has been utilized for value creation. IS researchers have studied how IT-enabled openness triggers collaboration and, ultimately, can lead to value co-creation (Schlagwein, Schoder, & Fischbach, 2010). For example, the optimal degree of openness (Boudreau, 2010; Ondrus, Gannamaneni, & Lyytinen, 2015), or suitable governance mechanisms to manage collaboration with third-parties on platforms (Tiwana, 2014; Tiwana et al., 2010) have been discussed. However, these results are, by vast majority, deducted from analyses of digital-native companies such as Google, Facebook or Salesforce. Consequently, it is unclear to what extent these findings are applicable to established companies and how the specific challenges of established companies are addressed by our existing understanding of value co-creation through openness and collaboration.

For example, established companies draw on their legacy systems when designing and implementing the IT platforms to be accessed by third parties (Lyytinen & Rose, 2003). However, the legacy systems are connected with other IT systems within the company and by opening them to external parties, the company risks to expose critical information and knowhow. Furthermore, openness of the IT platform may have a detrimental impact on employee’s motivation. Research on the *not-invented-here* and *not-shared-here* phenomena shows that openness can lead to internal resistance to collaboration with external parties (Burcharth, Knudsen, & Søndergaard, 2014). Consequently, it is unclear to what extent existing findings on value co-creation are applicable to established companies and how the specific challenges of established companies can be addressed by our existing understanding of value co-creation through openness and collaboration. Therefore, we strive to answer the following research question: *How can established companies successfully co-create value through IT platforms that utilize the concepts of openness and collaboration?*

To answer this question, we engage in an exploratory field study with a large European banking company that is introducing an open IT platform to spark value co-creation. The banking context is particularly interesting when analysing the transition towards a value co-creation strategy: First, digitization creates pressure on established banks to offer innovative digital services to their customers (Mention, Martovoy, & Torkkeli, 2014). Start-ups from the IT domain referred to as “fintechs” have come up with innovative solutions that target the core of the banking business, putting pressure on established banks to find appropriate responses. Second, due to the criticality of the data in banking and the need for security, banking companies have traditionally built up closed IT systems and have only collaborated in close strategic partnerships. Over the years, these IT systems have become highly complex and every structural change represents a huge challenge to the banking companies. Third, the European banking sector is affected by changes in regulation as for example triggered by the financial crisis in 2008. These changes need to be accommodated by the IT systems, which consumes valuable resources no longer available for innovative projects (Mention et al., 2014).

With this exploratory field study, our goal is not only to sketch the situation of that specific banking company striving for value co-creation but also to contribute to our theoretical understanding of value co-creation through openness and collaboration for established companies. To do so, we establish a theoretical pre-understanding of how openness leads to value creation through collaboration on IT platforms and embark on an exploratory field study. We derive areas of conflict and potential benefits that established companies face when shifting to a value co-creation strategy.

2 Theoretical Background

As recommended for exploratory field studies (Walsham, 1995), we develop a theoretical pre-understanding of value co-creation, with openness and collaboration as main constructs that facilitate value co-creation (Figure 1). We present our theoretical pre-understanding along the three elements (1) value co-creation, (2) openness and (3) collaboration.

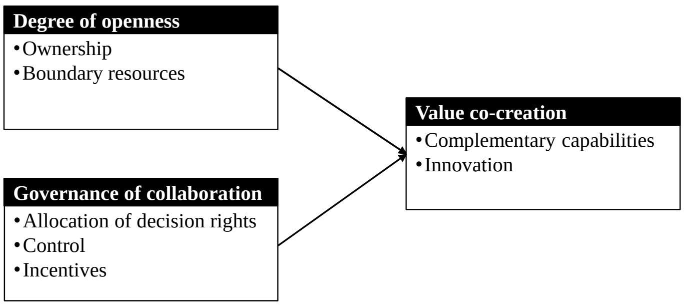

Figure 1. Theoretical pre-understanding of value co-creation through openness and collaboration.

The focus of value creation shifts from linear value creation in supply chains to **(1) value co-creation** within networks of companies, often facilitated by IT platforms (Fuentelsaz, Garrido, & Maicas, 2015; Huntgeburth et al., 2015; Sarker, Sarker, Sahaym, & Bjørn-Andersen, 2012). We define IT platforms as “[…] the extensible codebase of a software-based system that provides core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate” (Baldwin & Woodard, 2008; Boudreau, 2007), allowing companies to collaborate with third-party developers in order to co-create value. Following a resource-based view, value co-creation is a result of combining complementary resources and capabilities in a process of collaboration (Lavie, 2006). Besides sharing knowledge and assets, governance structure that frames collaboration is prerequisite for value co-creation (Grover & Kohli, 2012). For many companies, a key goal of value co-creation is innovation, as they lack innovative capabilities and want to benefit from the creativity and impartiality of externals (Boudreau, 2010; Yoo, Boland, Lyytinen, & Majchrzak, 2012; Yoo, Henfridsson, & Lyytinen, 2010).

To combine complementary capabilities and to realize joint innovation, openness on the technology level is required (Ceccagnoli, Forman, Huang, & Wu, 2012; Huff et al., 2013; Reichwald & Piller, 2006).

Through **(2) openness,** the focal firm grants third-party developers access to its IT. These third-party developers can then build complementary applications, which are consumed by the end-users (Benlian, Hilkert, & Hess, 2015). Usually, this process is mediated by an IT platform. Openness, in its most extreme form, can mean to give up ownership of the technology and make it accessible as a whole to everyone. Open source platforms such as Linux show that such a high degree of openness can lead to flourishing platform ecosystems (Economides & Tåg, 2012; Eisenmann, Parker, & Van Alstyne, 2009). However, in commercial platforms, the ownership of the technology in most cases lies with the focal firm, which acts as platform owner. Through boundary resources such as application programming interfaces (API) and associated tools and documentation, third-party developers are granted access to the technology (Eaton, 2015; Ghazawneh & Henfridsson, 2013). Depending on the characteristics of this access, different degrees of openness can be realized. Finding the right degree of openness is an important challenge (Schlagwein et al., 2010). A high degree of openness stimulates activity on the platform and, through positive network effects, can lead to a flourishing platform ecosystem (Parker & Van Alstyne, 2005). At the same time, with a high degree of openness, the focal firm gives up its control of the relationship with the customers. Third parties intervene with potentially innovative solutions for the end-users while the focal firm is at risk to be reduced to a pure technology provider. IS literature has shown that openness on the technology level contributes to a platform's market potential while openness on the provider level can have a negative impact on the market potential (Ondrus et al., 2015).

While openness is prerequisite for enabling value co-creation via an IT platform, the focal firm will only be able to create value from the platform if it can successfully realize **(3) collaboration** with third-party developers. Governing collaboration on a platform is a challenging endeavour that has been discussed extensively in IS literature. Collaboration ca be governed through the three mechanisms *allocation of decision rights*, *control*, and *incentives*, which are also referred to as governance mechanisms (Manner, Nienaber, & Schermann, 2013; Tiwana et al., 2010). By allocating decision rights to third-party developers, a decentralized governance structure is established that grants greater independence to third-party developers as compared to suppliers in a supply chain (Hein, Schreieck, Wiesche, & Krcmar, 2016; Schreieck, Wiesche, & Krcmar, 2016). For example, the third-party developer is free to come up with the specification of his complementary product, whereas a supplier has to fulfil the focal firm's specification. This autonomy creates space for innovation (Shi, Liang, Shao, & Shi, 2016; Yoo et al., 2012). At the same time, the platform owner needs to apply control mechanisms in order to ensure the integration and quality of complementary products. Both formal control mechanisms such as quality checks and informal control mechanisms such as clan control through a community of third-party developers have been shown to be effective (Boudreau, 2010; Goldbach & Benlian, 2014, 2015; Goldbach & Kemper, 2014). Furthermore, third-party developers need to be incentivized to collaborate on the platform, which is mainly done via revenue sharing. The optimal revenue sharing depends on many factors such as the end-users willingness to pay for quality (Lin, Li, & Whinston, 2011) or the position of the focal firm relative to competitors (Hagiu, 2006).

In sum, the theoretical pre-understanding shows that the current state of IS research can be condensed to a model explaining value co-creation through openness and collaboration. However, the current understanding is not sufficient to cater to the specific challenges of established companies that shift towards a value co-creation strategy. For example, the impact of legacy systems or the company's culture on openness, the influence of existing partners and customers on collaboration or the interplay of existing mechanisms of value creation and the to-be established mechanisms of value co-creation are not covered. This is illustrated by the fact that almost all case studies in the context of value co-creation focus on digital-native companies and start-ups such as Google, Facebook or Salesforce (e.g. Claussen, Kretschmer, & Mayrhofer, 2013) or other companies active in mobile payment (e.g.

Gannamaneni, Ondrus, & Lyytinen, 2015; Ondrus et al., 2015), e-commerce (e.g. Avgerou & Li, 2013), and cloud computing (e.g. Huntgeburth et al., 2015).

3 Research Design

Based on the theoretical pre-understanding, we selected *APIbank* (anonymized) as a suitable case to improve our understanding of value co-creation for established companies. In this section, we describe the case and our methodological approach.

3.1 Case Description

APIbank is a global banking and financial services company based in Europe. It runs offices in more than 70 countries and generates the lion's share of its revenue with investment banking. The company sees itself in a process of digital transformation with the goal to offer a seamless customer experience via multiple channels for both individual and business customers. The process of digital transformation is also the company's answer to the "fintechs", tech start-ups attacking the key business of established banking companies. One example of a fintech is Lending Club, a UK-based platform for peer-to-peer money lending, excluding established banks from their core business of gathering money from customers to lend it to others. One important step in the digital transformation of *APIbank* is the creation of an open API platform. This platform makes some of the banks data and functionalities accessible to third-party developers. Via APIs, the developers can integrate data or features into their applications. For example, a third-party developer could build a tool for small companies that integrates their transactions and invoicing with their account at *APIbank*.

We selected *APIbank* as company for the case study as the banking context represents a promising area of study. Banking is an industry in which the direct contact with the end-users regardless whether they are individuals or businesses has traditionally been the basis for conducting business. The direct contact builds trust, an essential factor in customer relationships which is even more relevant in banking than in other industries. However, openness and collaboration with third parties brings additional actors in the customer relationship, creating areas of conflict as well as potential benefits for *APIbank.*

3.2 Exploratory Field Study

To close the theory gap of value co-creation through openness and collaboration for established companies, we take on an interpretivist stance (Conboy, Fitzgerald, & Mathiassen, 2012; Goldkuhl, 2012) and conduct an exploratory field study with the company *APIbank* (Miles & Huberman, 1994; Walsham, 1995; Yin, 2013). In this setting, an exploratory field study is suitable for two reasons. First, the subject of our study, established companies that adopt a value co-creation platform strategy, is complex and dynamically evolving. It is thus advisable to study this phenomenon in its context with an iterative interplay of data collection and analysis. Second, the theory gap we identified is worthwhile to be researched with an explorative, inductive approach. Due to the heterogeneous and young field of platform theories, developing a theoretical framework and formulating hypothesis upfront is hardly feasible (Creswell, 2013; Urquhart, Lehmann, & Myers, 2010).

Conducting the exploratory field study, we iteratively collected interview data, as interview data provides access to the participants' interpretations of the phenomenon (Miles & Huberman, 1994; Walsham, 1995). We conducted semi-structured interviews with employees and externals involved in the open API project in different positions following the guidelines by Gläser and Laudel (2009). To embrace depth and richness of the data, we conducted the interviews inspired by grounded theory methodology (Glaser & Strauss, 1998; Mason, 2006; Urquhart, 2013). That is, we iteratively revised our interview guidelines based on the insights of interviews that we had already conducted. We chose subsequent interview partners based on the saturation of our constructs from the data that we had already collected. In total, 11 interviews were conducted between April and July 2016 (Table 1). Most of the interview partners have previous experience related to open innovation and value co-creation in IT. The interviews lasted 52 minutes on average. The interview questions covered the decision process that led to a co-creation strategy, the architecture of the open API, internal and external challenges as well as expectations associated with the value co-creation strategy.

ID	**Role**	**Brief description**
PM	Project manager	• Vice president of *APIbank* and project manager of the open API project • 6 years of experience in open innovation and open API projects • Participation in various workshops on open innovation in the IT context
PT_1	Project team member	• Architect head for digital transformation and innovation • Several years of experience with projects in the context of innovation and openness of IT
PT_2	Project team member	• Innovation manager with experience in open innovation at different companies • First employee to push the open API idea
PT_3	Project team member	• Product marketing and strategy • Former researcher with a focus on innovation and open innovation in large companies
PT_4	Project team member	• Lead digital solution architect • Responsible for internal adherence to API standards
PT_5	Project team member	• Solution architect • Product owner of internal API that forms the basis of the open API
RT_1	Member of related teams	• Solution architect in the investment department • Designing the connection of IT services in the investment department and the open API
RT_2	Member of related teams	• Technical specialist in the investment department • Implementing the connection of IT services in the investment department and the open API
TP_1	Third-party developer	• Experienced third-party developer • 19 years of experience in web development
TP_2	Third-party developer	• Junior third-party developer • Some experience in Java applications
EX_1	External consultant	• Experienced external consultant with focus on open innovation projects • Focus on operating mode for the bank with regard to the open API project

Table 1. Profiles of the interviewees.

Based on our interpretivist stance, we applied grounded theory based coding techniques following the Glaserian approach (Glaser & Strauss, 1998; Urquhart, 2013). We started with open coding and created more than 250 codes associated with more than 500 interview quotes. In axial coding, we identified 12 main categories of codes that included more than 40 subcategories. Subsequently, we conducted selective coding to relate the categories to our theoretical pre-understanding (Table 2). Following the principle of constant comparison (Urquhart et al., 2010), we returned to the data whenever a relationship emerged in the selective coding to verify its grounding in the data.

Interview statement and exemplary open codes (underlined)	**Subcategories**	**Category**
"<u>We have critical mass already.</u>[1)] [...] compared to start-ups, something like the Solaris Bank who were also offering banking as a service to start-ups. But their problem is that they can only offer a backend but they cannot offer customers. On our platform, we have several million customers. The thing is that <u>for our platform the external developers will be able to access [...] all our customers.</u>[2)]"(PM)	1) Advantage of established company 2) Incentive for developer to participate in open IT platform 2) Collaboration	Potential benefit (Collaboration → Value Co-creation)

Table 2: Illustration of coding scheme.

4 Results and Interpretation

The analysis and interpretation of our interview data helped us to, first, understand how *APIbank* applies openness and collaboration to co-create value through an IT platform and, second, which areas of conflict and potential benefits result from the new value co-creation strategy.

4.1 Openness

The interviews we conducted at *APIbank* shed light on why the company strives for more openness on the technology level and what consequences might come along with increasing openness. While the bank keeps ownership of its technology, it grants access to banking functions via APIs accompanied with additional boundary resources. In particular, a developer portal, API documentation, sample code and sample applications support third-party developers in their development process. With open APIs and the associated resources, *APIbank* aims at attracting developers that build innovative third-party applications on top of the open API platform. As the project manager summarized,

> *"Our plan is to support [the developers] in this activity by providing them with an easy to onboard and easy to use […] environment that it is really effortless to use. And a comfortable set of developer tools around this API, good documentation, good sample code, basically we are aiming for developer convenience. This is what we are going for. And this is what is going to make it attractive for people to use and if that's the case then it will spark innovation." (PM)*

Also from the third-party developers' perspective, openness provided by APIs is a suitable tool to facilitate innovation. Easy access to the API and the possibility to try out the different features of the API motivates third-party developers to produce prototypes:

> *"I think the great [thing] about APIs is that you can debug prototypes very easily faster. And that's related to innovation because I feel like there are lot of smart innovation methods to ideate things to define thinking but at the end it is to create something people can touch. And if you are able to create this fast." (TP_1)*

Area of conflict – Internal resistance. The idea of an open API platform was generated bottom up by a small group of employees that recognized the trend of fintechs targeting *APIbank's* key markets. While the project was supported by top management early on, middle management and parts of the staff were opposed to the open API project. Middle management criticized that the considerable investment in the project came along with uncertainty about the financial outcome. Compared to digital-native companies that opened their systems from the beginning, established companies need to invest in a redesign of existing IT systems to make them ready for more openness. Therefore, middle management feared the negative impact of the open API on their key performance indicators and asked the project team for business cases of the open API project:

> *"when I talk to managers on […] managing director level, and they would ask me for business cases. That puts me in the situation to explain, that open innovation approaches do not work the pipeline way, in which in-house products are designed and produced and introduced to the bankers […]. So, it is not always easy for me to supply them with business cases […]" (PT_3)*

Beside the reluctance of middle management, staff is concerned how openness affects their work and their role. Partnering with third-parties through open IT such as an IT platform requires an open mind-set and the willingness to share not only knowhow and experiences but also potential revenue with third-parties. As hypothesized by the *not-shared-here* phenomenon (Burcharth et al., 2014) personnel of *APIbank* in parts tends to be opposed to collaborate with externals.

> *"The [concern] is that the understanding of partnering and that the business can change, is also a change in the mind-set. Probably you are afraid that in a future world your role might look different. All these things. Bottom line is, […] understanding the API as well as what would it mean for the organization and the person who you are talking to." (PT_2).*

This internal resistance poses a threat to the project as the open API project team relies on the support from middle management as well as from other teams that work on the provision of banking functionality through IT systems.

Area of conflict – Criticality of technology. A further area of conflict arises from the criticality of banking functions. As a result, the decision what features and data to make accessible via the API is coordinated through a long and circuitous process that includes both business and technology functions within *APIbank*.

> *"The main thing is that before we go live with any new functionality, we have to go through legal obligations and all those business functions which verify if it's ok to go live and then still our business counterpart has to verify if this functionality or the data behind it fits into what people might do with it and therefore if it's okay for the business to provide the data to other people out there or not." (PT_4)*

In the first step, *APIbank* decided to only provide read functionality for most functions via the API. Third-party developers, however, expect access to the functions that they associate with banking, i.e. *"the online banking functionality I am used to"* as one third-party developer (TP_1) stated. This goes beyond read functionality and includes functions such as executing financial transactions. As the open API project does not fulfil that expectation yet, it remains questionable whether the degree of openness is sufficient to incentivize third-party developers to join the platform.

Potential benefit – Internal transparency and standards. Striving for openness in an established business with grown IT systems also entails potential benefits. Openness to the outside first requires transparency and standards on the inside. Existing data sets have to be reviewed, revised and structured consistently before they can be published via an API. Similarly, backend functionality has to adhere to internal standards in order to make it accessible via APIs. As the backend functionality has grown over years, *APIbank* had to reengineer parts of the backend or use an internal middle layer to standardize the functionality. In the long run, this leads to a cultural change within *APIbank*, reinforcing internal transparency and standards:

> *"We have this approach that you have to create properly one pool of data because it is really interesting for others to work with the data. We have to simplify the structure via API functions to the backend […] and then you have the organization who was used to work in silos and the you have a cultural change." (PT_2)*

The project manager is convinced that the open API project will be of formative character for internal culture and, henceforth, for the management of internal development projects.

> *„[…] internally, API will become a philosophy, so it will be clear that access through any system happens only via API." (PM)*

4.2 Collaboration

By establishing openness through the open API project, *APIbank* strives for collaboration with third-party developers to enable innovation. Both individual developers and other companies are encouraged to leverage the APIs for their own applications. As the third-party developers are not part of the company and often not even of the industry, they do not suffer from organizational blindness (Knudsen, 2011) and therefore are more likely to create innovative ideas and applications:

> *"[…] the purpose of the banking API is to attract people, to attract businesses to use the API to enhance some offering that isn't obviously connected to banking but somehow profits from banking. So this is the objective." (PM)*

Granting access to an API alone is unlikely to spark sustainable activity of third parties on the platform. A set of mechanisms referred to as governance mechanisms needs to be implemented to establish collaboration on platforms (Tiwana, 2014). By allocating decision rights among the actors on the platform, controlling the activities and products on the platform and incentivizing third parties to join the platform, a suitable governance strategy can be implemented (Tiwana, 2014; Tiwana et al., 2010). Regarding the allocation of decision rights, *APIbank* keeps all strategic and implementation-related decision rights on the platform level. Strategic and implementation-related decision rights on the application level are in large parts allocated to the third-party developers. However, some boundaries are defined by *APIbank* regarding for example the quality standards of the application. These boundaries are enforced with control mechanisms such as aformal input control of application that are created on the platform:

> *„The third-party apps […] have to fulfill some standards. There will be due diligence on the apps before they are allowed to start using the […] API. So we will do a due diligence on the apps similar to what Apple does." (PM)*

APIbank strives to gather early feedback of the third-party developers on how they perceive the governance strategy and to actively include them in the improvement of the governance.

> *"[…] run a couple of hackathons and just get feedback. It is most important. […] And just don't wait for years, just get started and ask for the feedback because [the third-party developers] tell exactly what is good and not. There's lot discussion about what's the best technology, what's the standard, how to design an API, technology wise that's quite important. […] How to design a good API. But main thing is asking for feedback, the users. That's the main thing." (PT_1)*

Area of conflict – Migration of partners. As *APIbank* has a long history of partnering with selected companies, these established partners will be affected by the new value co-creation strategy**.** The mode of collaboration is changed from close partnerships to standardized relationships on the platform. Thereby, the partners give up decision rights as *APIbank* defines how collaboration is organized and no individual agreements are negotiated. This is laid out by the project manager:

> *"I think the biggest difference between partner approach and open [approach] is that in the partner approach you are entering a specific and individual business agreement with a specific partner where there is a lot more responsibility on the bank's side, which is more the classical model where you have to do vendor risk management and other things which is all very expensive and very time consuming. Whereas in the open case most of the responsibility isn't with the bank. It is a very, very clearly defined interface with generic conditions with no special terms regarding the API consumer." (PM)*

This change may lead to conflicts with the existing partners who lose the status of being one of few exclusive partners.

Area of conflict – Image of being inert. Another area of conflict results from the inflexible, slow image which is often attributed to established companies such as *APIbank*. The sheer size of many successful established companies along with the business processes that have been established over the years lead to long lead times of new projects and organizational changes (also referred to as organizational inertia, e.g. Hannan & Freeman, 1984). Established companies oftentimes are not perceived as frontrunners in the area of innovative digital solutions, in particular compared to digital-native companies such as Google, Facebook, Salesforce or fintech start-ups. One member of the project team at *APIbank* acknowledges:

> *"We can't build with what we want because they are lot of other internal operational processes which don't allow going in that direction. We have limited access to some sources. Fintechs don't have all these problems. [They] just can try, they can throw it away if it doesn't work. And they are really fast. And this is the thing we have to change in our process […]. They can just start to build from scratch, and they can whatever just produce something quickly, couple of weeks sometime. They can just try it and go to the market, see if it works and that's it. […] If we start a project it will take months sometimes more than a year to go to production. This is the big advantage of fintechs." (PT_1)*

This image can be harmful to *APIbank's* open API project as the project is depending on collaboration with innovative developers.

Potential benefit – Existing partners. The existing partners of *APIbank* not only represent an area of conflict but also a potential benefit. Partners who used to work closely together with *APIbank* can promote or even sponsor the platform which helps to establish the platform on the market (Eisenmann et al., 2009). In particular, in the early phase of the platform, existing partners can test the platform, give valuable feedback and develop first applications that showcase the potential of the APIs. Therefore, *APIbank* started with selected existing and new partners in the API project before making the APIs available to everyone:

> *"For the very start we stuck with the partnering approach because this is a very early stage thing now. And we wanted simply to start with handful of selected partners, […] it's a development based planning approach." (PT_5)*

Potential benefit – Existing customers. The existing business relationships that *APIbank* has with end-users create a huge potential for the shift towards a value co-creation strategy. With one side of the platform being already present, the chicken-egg problem which is inherent to platform businesses (Caillaud & Jullien, 2003; Evans & Schmalensee, 2010) is basically solved. If third-party developers are allocated a share of the revenue that is created on the platform, the large customer base represents a huge incentive to participate in the platform. The project manager summarized this as follows:

> *"We have critical mass already. […] compared to start-ups, something like the Solaris Bank who were also offering banking as a service to start-ups. But their problem is that they can only offer a backend but they cannot offer customers. On our platform we have several million customers. The thing is that for our platform the external developers will be able to access […] all our customers. […] So, from a development perspective there is a million or whatever pool of customers potentially who would be customers for the application." (PM)*

4.3 Value Co-creation

Taken together, openness and collaboration lead to value co-creation on the API platform. The goal of *APIbank* is to co-create innovative solutions that the company would not be able to develop or that it would not have thought of. Access to complementary capabilities that third-party developers possess as well as the benefit from innovative ideas from outside of the company are the key reasons for *APIbank* to establish a value co-creation strategy:

> *"[…] you cannot do everything yourself. As a big company, we are simply not fast enough to come up with new innovative ideas and then in addition to that you find […] start-ups that just focus on one piece of the value chain, they do really good. And I think that's also related to what customers perceive." (PT_2)*

In addition to the fact that *APIbank* would not be capable of "doing everything", it would not always know what to do as the established structures and processes inhibit innovativeness. Relying on the crowd can yield many different ideas for complementary applications, some of them with great potential for success.

> *"If we just go outside, outside of [APIbank], people have ideas; people don't care about internal [APIbank] technology and how it gets managed and all. They just have ideas. So, I think there are so many people outside, crowd itself is innovative and let's say, if 10 people have ideas, one of them will be a really good one. So, the crowd itself is the innovative part. Not [APIbank] here because we build our own processes. We decide what is important for the customers and some other ideas showing up, and users they have other thoughts about it. They are not really interested in [APIbank's] processes." (PT_1)*

Emphasizing a value co-creation strategy brings along areas of conflict and potential benefits.

Area of conflict – Threat to existing business. As *APIbank* has existing mechanisms of value creation, conflicts between those mechanisms and the newly introduced mechanism of value co-creation can arise. A third-party developer who creates a financial manager that helps users keep an eye on expenditures would not pose a threat to *APIbank's* key value propositions. It could even be a win-win situation as the financial manager could make the *APIbank's* online and mobile banking more attractive. A third-party developer that creates a peer-to-peer lending platform such as Lending Club using the open API would exclude the bank from the transaction of lending money and could therefore harm *APIbank's* existing mechanism of value creation.

> *"When we are partnering with others, we would like to understand their business model. […] we are looking for the business model if it is fine for [APIbank]. […] So, these criteria need to be defined by us." (PT_1)*

This statement visualizes a tradeoff that *APIbank* faces when following a value co-creation strategy. On the one hand, openness should create a flourishing ecosystem of innovations while, on the other hand, potential harmful ideas should be avoided.

Area of conflict – Loss of access to customer. A second area of conflict arises from the fact that the applications based on the open API will most likely directly address customers, thus creating a competing channel to *APIbank's* channels to the customer. However, losing the touch point with the customer would make *APIbank* a pure technology provider that is not visible to the customer anymore and that is easily replaceable. The project team members have recognized this area of conflict:

> *"So, there are some critical strategic points, for example, we do not want to lose the central touch point with the customer or we must not lose it, let us put this way." (PT_3)*

> *"[…] the business side, they are always afraid of providing the assets we earn money with to the other people, to other third parties so we might just go into the background and be a just a platform which going to be white-label-wise used by others." (PT_4)*

Potential benefit – Absorption of third-party developers. Established companies such as *APIbank* have often built up experience in acquiring smaller companies and integrating them into their processes and mechanisms of value creation. This experience can prove useful when shifting towards a value co-creation strategy. With this experience *APIbank* has the flexibility to observe the third-party developers while sharing revenue with them as long as promising acquisition options arise. These acquisitions not only strengthen *APIbank's* product portfolio but are also a way to find innovative and entrepreneurial employees (Fantasia, 2016).

> *"And if there is a partner that delivers such a great value […] successfully to our customers, it would be an interesting question if we should buy him. […] we do have experts for that around. And I don't think that it should be a problem of not knowing of how to do that." (PT_3)*

This potential benefit can therefore mediate the threat that a value co-creation strategy poses to the established business of *APIbank*.

5 Discussion and Conclusion

In this section, we provide a summary of the areas of conflicts and potential benefits that established companies face when shifting towards a value co-creation strategy. Based on our insights from the exploratory case of *APIbank*, we enhance our theoretical pre-understanding.

5.1 Areas of Conflict and Potential Benefits for Established Companies

When defining the degree of openness for an IT platform, established companies need to consider that opening up might cause internal resistance as these companies traditionally exhibit hierarchical structures. Granting access to critical parts of the company's technology is another risk for the companies' businesses. At the same time, internal structures will need to be made transparent and, to a certain degree, standardized. Both can enhance the company's competitiveness and innovativeness (Ebner, Leimeister, & Krcmar, 2009). When designing governance of collaboration on the platform, established companies might struggle to move their existing partners onto the platform and to convince innovative third-party developers to participate despite the established company's image of being too big and too slow. However, with the existing customers and partners, established companies have two assets that can have a major impact on the initial success of the platform. Existing customers incentivize third-party developers to join the platform and existing partners can act as sponsors that spread the platform. When constituting the mechanisms of value co-creation through the IT platform, established companies need to consider the impact of value co-creation on existing mechanisms of value creation and the threat of losing direct access to customers. However, the value co-creation also offers the opportunity to discover and absorb innovative complementary products or even the third-party developers themselves. The areas of conflicts and potential benefits enhance our understanding of how openness and collaboration facilitate value co-creation through IT platforms for established companies (Figure 2).

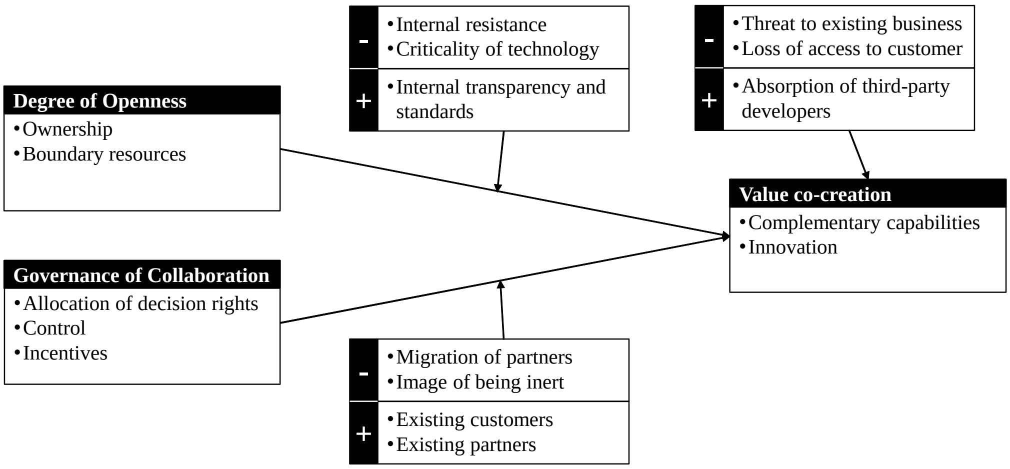

Figure 2. Revised theoretical understanding of value co-creation through openness and collaboration.

Our results provide first starting points on how to mediate the areas of conflict and realize the potential benefits. First, the areas of conflicts and potential benefits can be addressed individually. For openness, the area of conflict related to internal resistance could be addressed by *"API evangelists"* (PT_2) that promote the API project internally and externally, and explain the potential benefits to doubters. For collaboration, a strategy needs to be developed how to manage existing partners, for example by providing them guidance on how to use the platform themselves or how to enhance the platform with additional APIs adhering to the same structures. To convince third-party developers to participate even though the platform is not initiated by a digital frontrunner, events such as hackathons can be organized (Leimeister, Huber, Bretschneider, & Krcmar, 2009).

Second, a fit between the degree of openness and the governance of collaboration contributes to solving the trade-offs related to value co-creation. In particular, to avoid the threat to the existing business and the loss of direct access to the customers, a careful alignment of openness and collaboration is necessary. While the case of Apple's app store is referenced several times by different interview partners, our results suggest that a digital marketplace with millions of applications and standardized relationships with the third-party developers might not be the most suitable approach for established companies. Given the fact that established companies do not need a high number of complementary products from the start as customers are already on the platform, it makes sense to initiate value co-creation with selected partners and gradually open up to further third-party developers depending on their intentions.

5.2 Contribution to Theory and Practice

With our revised theoretical understanding, we contribute to recent IS literature that focuses on openness of IT and value co-creation through collaboration via IT platforms. The organizing logic of open platforms has been promoted in literature for a while now (Fuentelsaz et al., 2015; Sambamurthy & Zmud, 2000) but insights for established companies have been scarce so far.

Our results show that the tension between openness and control inherent to platforms (Eaton, 2015; Ghazawneh & Henfridsson, 2013) is particularly relevant for established companies that implement a value co-creation strategy. While boundary resources mediate this tension as shown by Eaton (2015) and Ghazawneh and Henfridsson (2013), they are not sufficient to deal with existing partners that need to be moved onto the platform or with internal resistance to openness. Platform governance as discussed by Tiwana (2014) has proven to be a useful tool to facilitate value co-creation through digital platforms. We confirm that incentives, allocation of decision rights and control are key to governing collaboration on the platform also for established companies and we provide first insights on how governance can be implemented to cater to the specific situation of established companies. Our insights from one exploratory case need to be enhanced by more rigorous testing of, for example, the impact of different control modes in the context of established companies similar to the studies performed by Goldbach and Benlian (2014) or Goldbach and Kemper (2014) in the context of mobile app stores. By taking together our results on openness and collaboration for established companies, we contribute to an improved understanding of value co-creation via open IT platforms. We confirm that, following a resource-based view, established companies can benefit from open IT platforms by getting access to resources and capabilities of the third-party developers (Sarker et al., 2012; Thomas, Autio, & Gann, 2014). However, due to the impact of the value co-creation strategy on existing mechanisms of value creation and customer relationships, the resource-based view alone is not sufficient to evaluate value co-creation. Future research on established companies that implement a co-creation strategy could also consider the transaction cost perspective or the dynamic capabilities perspective (Drnevich & Croson, 2012). Finally, our results contribute to current IS literature on how the financial services industry is undergoing digital transformation and how it is responding to the trend of fintechs (Gaertner & Deutsche Bank AG, 2015; Kelly, 2014). Longitudinal studies of how fintechs interact with established banking companies that gradually open up would further increase our understanding.

In practice, our work firstly provides insights for banking companies that face specific challenges due to digitization, changes in customer preferences, and regulation (Mention et al., 2014). By showing potential benefits and areas of conflict deducted from a real case, we provide dimensions that need to be considered before engaging in open innovation activities with third parties. Not in every case, open innovation and co-creation will be the best solution nor does it provide answers to all challenges of the banking sector. Still, reflecting a banking company's situation in front of our findings helps to identify the right path. Secondly, numerous established companies from other domains consider a co-creation strategy or are in an early phase of implementing it. For example, the equipment manufacturer Trumpf has established a subsidiary, "Axoom" that is dedicated to creating a platform ecosystem around the machines Trumpf is manufacturing. For those companies, our work helps to evaluate the degree of openness on the technology level as well as governance strategies on the collaboration level. However, these companies need to consider that the findings are derived from the case of a banking company and need to be viewed in front of the own company's specific situation. Third, our findings can be adapted to further contexts where established organizations apply IT for collaboration, e.g. in e-government or non-profit work (Schreieck, Wiesche, Hein, & Krcmar, 2016).

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The Platform Owner's Challenge to Capture Value – Insights from a Business-to-Business IT Platform

Completed Research Paper

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Abstract

IS research has acknowledged the increasing importance of IT platforms. While substantial insights on value co-creation between the platform owner and complementors have been established, the platform owner's challenge to capture value remains largely unaddressed. We therefore conduct an exploratory field study of an enterprise software vendor who has launched a business-to-business IT platform. Conducting 27 interviews with actors involved in the platform ecosystem, we derive three distinct mechanisms of value capture: absorption, co-selling, and verticalization. We interpret how these mechanisms of value capture in turn affect value co-creation. With our results, we, first, enhance literature on value in IT platforms by adding mechanisms of value capture to the already established mechanisms of value co-creation. Second, we contribute to the discussion on the impact of digital business strategies on firm performance by showing that an organization that implements an IT platform needs to consider value co-creation and value capture jointly.

Keywords: Value capture, IT platform, platform ecosystem, value co-creation, platform owner

Introduction

In today's hypercompetitive markets, firms no longer create value on their own or in dyadic relationships with supply chain partners. Instead, firms co-create value with partners as part of a fragmented interfirm network (Bitran et al. 2007; Pagani 2013). In order to benefit from value co-creation in their interfirm networks, firms need to capture a sufficient share of the value that is co-created (Bharadwaj et al. 2013; Rai and Tang 2014). As value co-creation and capture can affect each other in both reinforcing and alleviating ways, it remains a key challenge for firms to make most of the interfirm networks they are involved in (Lepak et al. 2007).

In the last decade, digital business strategies have emerged that rely heavily on IT to coordinate different actors participating in value co-creation (Bharadwaj et al. 2013). In particular, IT platforms supporting multisided digital business models have proven to enable value co-creation in interfirm networks (Grover and Kohli 2012; Venkatraman et al. 2014). IT platforms are IT artefacts that provide core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate (Baldwin and Woodard 2008; Boudreau 2007), thus they enable collaboration with partners and "unlock" the potential of a broader ecosystem of complementors (i.e., third-party developers) for value co-creation (Kuk and Janssen 2013; Zittrain 2006).

While value co-creation on IT platforms has been intensely studied during the last years, the platform owner's challenge to capture value is still poorly understood. We identify two main reasons why this is the case. First, the IS domain has predominantly focused on the effect of IT on value co-creation, for example the effect of improved coordination in supply chains through IT integration (Rai et al. 2006). Value capture is rarely considered as distinct mechanism alongside value co-creation – although this approach has been identified as relevant and promising in strategic management research (Lepak et al. 2007; Priem 2007). In research on IT platforms, for example, boundary resources (Eaton et al. 2015; Ghazawneh and Henfridsson 2013) and control mechanisms (Boudreau 2010; Manner et al. 2013; Tiwana 2015) have been shown to contribute to value co-creation. However, it remains unclear what share of the co-created value accrues to the platform owner. Few distinct mechanisms of value capture have been identified such as pricing (Hagiu 2006; Tiwana 2014) and bargaining (Oh et al. 2015) between platform owner and complementors. These mechanisms have been derived from ideal platform models and may not sufficiently acknowledge the "complex and dynamic coordination across multiple companies" that is required in IT platforms (Bharadwaj et al. 2013, p. 478).

Second, in digital business strategies, value is captured from interfirm networks, thus value capture mechanisms might in turn affect the ongoing value co-creation in the interfirm network (Bharadwaj et al. 2013; Rai and Tang 2014). In the context of IT platforms, value capture refers to claiming parts of the value that is co-created within the platform's ecosystem (Venkatraman et al. 2014). This requires mechanisms that let platform owners claim a share of the value in the interfirm network without alleviating value co-creation. For example, the platform owners can provide boundary resources to their partners to enable them to co-create value, while claiming a certain share of their revenue (Eaton 2012). As the share the platform owners claim gets bigger, the partners' incentives to co-create decrease. This interaction is raised in literature on IT platforms (e.g., Tiwana 2014), but has rarely been analyzed for distinct mechanisms of value capture. Our overall research objective is therefore *to develop an empirical understanding of the mechanisms platform owners apply to capture value from IT platforms and how these mechanisms in turn affect value co-creation.*

Towards this end, we conduct an exploratory case study of an enterprise software vendor who has launched a business-to-business (B2B) IT platform. This case is particularly suited to explore value capture, as the platform owner *IS-Corp* (anonymized) is an established, successful organization that has already gathered significant experience in implementing IT platforms. Based on the explorative case study, we observe a variety of measures taken to capture value from the IT platform. We classify the observed measures into three mechanisms of value capture: absorption, co-selling, and verticalization. We describe these mechanisms along with their manifestations and interpret their interaction effects on value co-creation.

With our results, we contribute to the understanding of how IT platform ecosystems generate value and how the different actors of the ecosystem share the generated value. This has implications for the ongoing debate of openness and control of IT platforms and informs the more general discussion of the performance of digital business strategies that are based on interfirm relationships (Bharadwaj et al. 2013). Our insights furthermore inform platform owners in their challenge to establish sustainable IT platforms.

Theoretical Background

As recommended for exploratory case studies, we develop a theoretical pre-understanding of value capture in IT platforms (Walsham 1995). This covers extant work on value co-creation and capture as distinct mechanisms as well as the current state of knowledge on value capture in IT platforms.

Value Co-creation and Value Capture as Distinct Mechanisms

To stand their ground in today's hypercompetitive markets, firms can no longer solely rely on their own resources and capabilities but need to collaborate with partners to leverage their resources and capabilities

(Ferrier et al. 2010; Tanriverdi et al. 2010). Consequently, the locus of value creation has shifted from the single firm to supply chains and, more recently, to interfirm networks that may be complex and fragmented (Bitran et al. 2007; Pagani 2013; Peppard and Rylander 2006). This shift in the locus of value creation corresponds to management researchers moving from the resource-based view (Barney 1991; Wernerfelt 1984) towards a relational view of the firm (Dyer and Singh 1998). To benefit from the interfirm relationships in these networks, firms need to address a twofold challenge: (1) co-creating value by aligning decisions, resources and activities with their network partners (Grover and Kohli 2012; Im and Rai 2014; Rai and Tang 2010) and (2) capturing a sufficient share of the value that is co-created within the interfirm network (Bharadwaj et al. 2013).

To outline this twofold challenge, we first clarify our understanding of the terms value, value co-creation, and value capture. We interpret *value* as exchange value, "the amount the consumer actually pays, representing revenue to a value system" (Priem 2007, p. 220, based on Bowman and Ambrosini 2000). The term value system in that definition illustrates that the recipient of the exchange value is not necessarily a single firm but can also be an interfirm network that co-created the value the customer pays for. With *value co-creation*, we broadly refer to the collaboration between multiple stakeholders (Ranjan and Read 2016). This understanding of value co-creation goes beyond co-creation with customers, a view coined in marketing literature (Chen et al. 2012; Prahalad and Ramaswamy 2000; Zwass 2010). Our understanding explicitly considers other organizations as partners for value co-creation, a view established in IS research (Han et al. 2012; Lempinen and Rajala 2014; Sarker et al. 2012; Schreieck and Wiesche 2017; Venkatraman et al. 2014). In particular, complementors of a platform ecosystem can be partners for value co-creation (Smedlund 2012). In line with that, we refer to *value capture* as "the appropriation and retention [...] of payments made by consumers in expectation of future value from consumption" that one member of a value system can claim for itself (Priem 2007, p. 220).

The twofold challenge of value co-creation and value capture has been acknowledged in management research on value creation, but Lepak et al. (2007) and Priem (2007) note that still many studies do not distinguish processes of value creation (such as value co-creation in the case of interfirm networks) and value capture. For example, the relational view of the firm identifies determinants for relational rents in interfirm relationships but does not clarify how these rents are shared among the partners in the interfirm relationship (Dyer and Singh 1998). Consequently, understanding and optimizing value co-creation in an interfirm network does not necessarily increase the focal firm's market performance – value capture has to be considered along with value co-creation (Bowman and Ambrosini 2000). As a rule of thumb, however, an increase in value co-creation leads to a better initial position for value capture. This relation is stronger, the better the focal firm's bargaining position vis-à-vis co-creation partners (Bowman and Ambrosini 2000). The differentiation of value co-creation and value capture can be crucial in situations where value is successfully co-created but a participant struggles to capture a sufficient share. For example, suppliers in the automotive industry nowadays play an important role in creating innovation together with the car manufacturers. Due to the strong market positions of the manufacturers, suppliers are in a difficult bargaining position to capture their share of the value created by the innovation (Prahalad and Ramaswamy 2000). Furthermore, there are situations in which value is co-created but some actors do not aim at capturing value as for example in open source communities (Shah 2006) or in non-profit organizations (Schreieck et al. 2017).

According to IS research, IT plays a crucial role in value creation of firms. In particular in today's complex interfirm networks, IT has become a central element of digital business strategies that include value co-creation within interfirm networks and value capture of different actors in the network (Bharadwaj et al. 2013). Thereby, IT as part of a digital business strategy can alter existing mechanisms of value co-creation and capture and introduce completely new mechanisms (Chen et al. 2010; Venkatraman et al. 2014). However, as digital products and services merge with the underlying IT infrastructure (Bharadwaj et al. 2013; El Sawy 2003), it becomes more difficult to identify the mechanisms of value creation and to distinguish between value co-creation and value capture as constituent parts of value creation. Similar to Lepak et al. (2007) in management research, Bharadwaj et al. (2013) state that differentiating value co-creation and value capture while considering their interplay will potentially bring our understanding of digital business strategies and their impact on the performance of IT platforms forward.

Value Capture in IT Platforms

Implementing IT platforms represents a digital business strategy enabled by new technological means such as cloud computing or in-memory databases (Bharadwaj et al. 2013). We define IT platforms as “the extensible codebase of a software-based system that provides core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate” (Tiwana et al. 2010, p. 676). Due to their extensible nature, IT platforms enable the platform owner to collaborate with partners to “unlock” the potential of a broader ecosystem of complementors for value co-creation (Kuk and Janssen 2013; Ondrus et al. 2015; Zittrain 2006). Thereby, IT platforms facilitate a multisided business model that brings together complementors on the one side and end-users on the other side. Taken together, we refer to the IT platform, its interfaces and complementary applications, and the platform’s stakeholder as platform ecosystem. The terminology related to IT platforms that represents our understanding in this study is summarized in Table 1.

Term	**Definition**	**Sources**
IT platform	“[T]he extensible codebase of a software-based system that provides core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate.”	Tiwana et al. (2010, p. 676); see also Baldwin and Woodard (2008)
Application (app)	An add-on software subsystem or service that connects to the platform to add functionality to it. Also referred to as a module, extension, plug-in, or add-on.	Parker et al. (2017); Tiwana (2014)
Interfaces	Specifications and design rules that describe how the platform and applications interact and exchange information.	Tiwana (2014)
Platform owner	An individual or organization representing the legal entity that owns the platform.	Tiwana (2014); Evans et al. (2006)
Complementor	Individuals or organizations that develop one or more applications for the IT platform (also referred to as third-party developers).	
End-user	Individuals or organizations that use the applications available on the IT platform.	
Platform ecosystem	The platform and the applications specific to it as well as the stakeholders of the platform. Also referred to as platform-based software ecosystem, or software ecosystem.	Cusumano and Gawer (2002); Tiwana (2014)

Table 1. Definition of Key Terms in the Context of IT Platforms

Existing research on IT platforms has predominantly aimed at explaining how IT platforms enable value co-creation between the platform owner and the complementors (Schreieck et al. 2016). For example, it has been found that boundary resources, that is, resources the platform owner provides to facilitate the development of complementary applications, stimulate value co-creation (Eaton et al. 2015; Ghazawneh and Henfridsson 2013). A balance of openness and control is required to optimize value co-creation (Boudreau 2010; Ghazawneh and Henfridsson 2013; Hein et al. 2016). However, value co-creation and value capture need to be combined in a cross-pollinating way to bring an IT platform forward (Ceccagnoli et al. 2012). The provision of boundary resources can be costly and thus impede value capture despite its positive effect on value co-creation. Similarly, increasing openness of a platform ecosystem can spark value co-creation but may also weaken the position of the platform owner to capture value. To understand how a digital business strategy such as implementing an IT platform is successful, it is necessary to identify and understand mechanisms of value capture as well as interaction effects between value capture and value co-creation.

To complicate matters, the notion of value capture in IT platforms differs from the more general strategic management interpretation of value capture as appropriating value from a market (Lepak et al. 2007; Lippman and Rumelt 2003). In the context of IT platforms, value capture refers to appropriating value from the overall value that is co-created in the collaboration of the platform owner with the platform’s complementors (Huang et al. 2012). As a result, insights from management research that revolve around “isolating mechanisms” are not applicable for value capture within IT platforms. Isolating mechanisms represent barriers to imitation that preserve profits in the face of competition. While these mechanisms might be relevant in competition between different IT platforms, they do not address the challenge of capturing value from the interfirm relationships within the platform ecosystem.

More recently, research on IT platforms has acknowledged the importance of value capture and provides first insights on how platform owners can maximize value capture. Considerations on pricing (Hagiu 2006; Tiwana 2014) and bargaining (Oh et al. 2015) help platform owners to configure revenue sharing with complementors in their favor. However, value capture in IT platforms goes beyond cashing a certain percentage of the complementors' revenue. For example, the absorption of complementary solutions (Eisenmann et al. 2009; Parker et al. 2017) or the investment in selected complementary products (Rietveld et al. 2016) have been laid out as possible mechanism of value capture. With the notable exception of (Rietveld et al. 2016), we lack empirical understanding of the mechanisms of value capture, as most results are derived from idealized models of large-scale platforms. Some IT platforms such as Google's Android come close to these models but the majority of IT platforms, particularly in the B2B context, are more heterogeneous and complex, changing also the context for value capture. For example, it remains unclear, how the degree of openness – a key decision to be made when implementing an IT platform (Ondrus et al. 2015) – is related to value capture.

In sum, IS research provides us with a good understanding of value co-creation in IT platforms, but lacks insights on mechanisms that enable value capture along with their interaction effect on value co-creation. Figure 1 locates value capture in IT platform ecosystems alongside value co-creation and Figure 2 illustrates the focus of our study based on our theoretical pre-understanding of value capture in IT platforms:

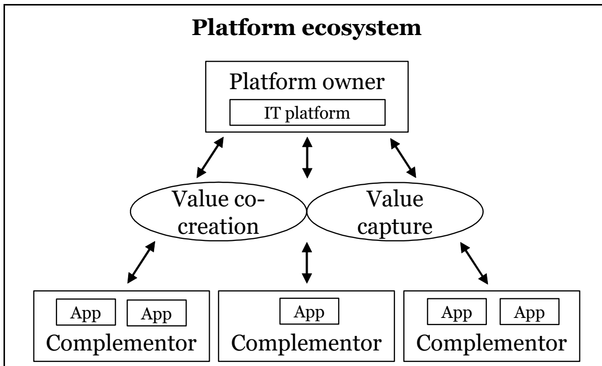

Figure 1. Value Co-Creation and Value Capture in IT Platform Ecosystems

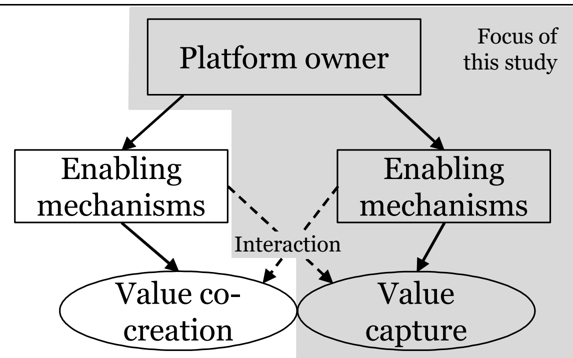

Figure 2. Theoretical Pre-Understanding of Value Capture in IT Platforms

Research Design

In this section, we describe our case organization and the explorative case study approach we adopted. An exploratory case study is suitable for several reasons. First, the subject of our study, firms that engage in IT platforms as digital business strategy, is complex and dynamically evolving. It is thus advisable to study this phenomenon in its context with an iterative interplay of data collection and analysis. Second, the theory gap of value capture we identified is worthwhile to be researched with an explorative, inductive approach. Due to the heterogeneous and young field of platform theories, developing a theoretical framework and formulating hypothesis upfront is hardly feasible (Urquhart et al. 2010).

Case Description

IS-Corp is a multinational software company focusing on enterprise software solutions. In this study, we focus on one of *IS-Corp's* core products, an enterprise software used in various industries and companies of different sizes. To develop and market this software, *IS-Corp* collaborates with a large network of partners. As customers expect the software to be an end-to-end solution that covers all relevant business processes, *IS-Corp* faces a merely infinite number of heterogeneous requirements across industries and countries. The software needs to consider characteristics of industry-specific processes as well as country-specific regulations such as fiscal laws. Consequently, *IS-Corp*, just as most enterprise software vendors, relies on partners that fill white spaces in the product portfolio, localize products, or support global sales activities (Leech and Schmidt 2011; Sarker et al. 2012). Thus, *IS-Corp* collaborates with various other software companies, IT providers, and IT consultancies. With the latest version of the enterprise software product that we analyze in this study, *IS-Corp* aims at opening the software to a large number of third-party developers by establishing an IT platform for third-party extensions (we refer to this platform as the "*IS-Corp* platform").

With its platform strategy, *IS-Corp* leverages the possibilities created by the advance of cloud computing. Cloud computing refers to the rapid provisioning of on-demand access to a pool of configurable computing resources such as networks, servers, storage, applications, and services (Mell and Grance 2011). As the performance of networks, servers, storages, and database technologies has increased continuously over the last years, it is now possible to provide larger enterprise software solutions via cloud computing. For example, large amounts of business data can nowadays be processed in real-time with in-memory database technologies. *IS-Corp* leverages cloud computing not only to make its own software more flexible and powerful, but also to facilitate the development of third-party applications. With its cloud-based *IS-Corp* platform, it provides application programming interfaces (APIs) that grant developers access to functions such as production data analysis. Third-party developers can utilize these APIs and the accompanying software development kit (SDK) to extend the business applications provided by *IS-Corp* or to develop new ones. As a result, an ecosystem of extensions to *IS-Corp's* enterprise software solution arises (see Gawer 2014 and Tiwana et al. 2010). Customers can download these extensions via a marketplace and deploy them rapidly, even during run-time.

The case of the *IS-Corp* platform is of particular interest for our study of value capture in IT platforms for several reasons. First, *IS-Corp* has experimented in the past with IT platforms and includes its lessons learned on value co-creation and capture in the current IT platform setup. Second, the project of the IT platform is central to *IS-Corp's* strategy. The firm is committed to the project and assigned sufficient resources. Finally, the *IS-Corp* platform represents a business-to-business (B2B) IT platform: both third-party developers and end-users represent firms. Analyzing this case allows us therefore to extend our understanding of value capture that, up to now, has been derived from business-to-consumer (B2C) IT platforms such as Google's Android that have a much larger base of end-users (e.g., Boudreau 2012; Ghazawneh and Henfridsson 2013; Goldbach and Benlian 2014).

Exploratory Case Study

To close the theory gap of value capture in IT platforms, we conducted an exploratory case study (Walsham 1995; Yin 2013). Taking on an interpretivist stance (Conboy et al. 2012; Goldkuhl 2012), we collected qualitative interview data and adopted a grounded theory approach (Glaser and Strauss 1998; Urquhart 2013) for coding and interpreting the data. As described below, we followed the grounded theory methodology procedures for data collection and analysis as summarized by Wiesche et al. (2017).

The selection of our case and our interview partners followed theoretical sampling considerations (Urquhart et al. 2010). Our case company needed to have an established way of co-creation value with partners on an IT platform, which it uses to capture value through different mechanisms, both being the case for *IS-Corp*. We started selecting interview partners that could describe the process of value co-creation and iteratively chose new interview partners to shed more light on value capture processes (Walsham 1995). We conducted semi-structured interviews with employees and externals involved in the *IS-Corp* platform project in different positions following the guidelines by Gläser and Laudel (2009). In total, we conducted 27 interviews with 29 interview partners between February 2016 and February 2017. The interviews lasted 58 minutes on average. The interview questions covered the history of the platform project, the processes of value co-creation and capture, and the interviewees' assessment of the platform project. We provide details on the interview partners and exemplary interview questions in Table 2.

Throughout our data collection and analysis, our focus was on discovery of concepts and relationships in the context of value co-creation and value capture (Urquhart and Fernandez). We did not aim at deductively testing relationships between value co-creation and value capture that authors have discussed in prior literature. The theoretical background we provided above rather helped us to contour our research project and to motivate our study.

IS-Corp (19 interviews; 21 interview partners)	
Interview partners ▪ High level managers responsible for the *IS-Corp* platform (e.g., project lead, chief architect, product owner) ▪ Employees that worked with the same software product before the introduction of the *IS-Corp* platform and could thus report on the changes inflicted by the platform strategy ▪ Relatively new employees that had gathered experience in platform projects at other companies	*Exemplary interview questions* ▪ "What are the core features of the *IS-Corp* platform?" ▪ "Can you describe the history of the *IS-Corp* platform project?" ▪ "In what ways are third parties involved in the *IS-Corp* platform?" ▪ "What is *IS-Corp's* business model behind the platform?"
Partners (8 interviews)	
Interview partners High level counterparts of *IS-Corp* within three different partner companies that offer specialized extensions of the *IS-Corp* platform: ▪ A software vendor (> 1,000 employees) with a focus on lifecycle management and go-to-market analyses ▪ An IT service provider (> 5,000 employees) with a focus on the financial industry ▪ A software vendor (> 10,000 employees) with a focus on solutions for enterprise content management	*Exemplary interview questions* ▪ "What is your company's motivation to contribute to the *IS-Corp* platform ecosystem?" ▪ "Can you describe the collaboration with *IS-Corp*?" ▪ "What resources does *IS-Corp* provide to support your development of complementary applications?" ▪ "What is your company's business model behind the collaboration with *IS-Corp*?"

Table 2. Details on Interview Partners and Interview Questions

For the coding process we followed the Glaserian approach (Glaser and Strauss 1998; Urquhart 2013). We illustrate our coding scheme in Table 3. We started with open coding and created 502 codes associated with 703 interview quotes. In axial coding, we identified 42 subcategories that summarized open codes related to the same aspect of value capture or to a positive or negative consequence of value capture. We clustered these subcategories to 12 categories that describe different manifestations of value capture as well as interaction effects on value co-creation. Subsequently, we conducted selective coding to relate the categories to specific mechanisms of value capture and to link those to our theoretical pre-understanding. Following the principle of constant comparison (Urquhart et al. 2010), we returned to the data whenever a relationship emerged in the selective coding to verify its grounding in the data. By using 24 memos in the process of coding, we captured ideas on concepts and their relationships early in the analysis (see Gregory et al. 2015).

Interview statement and open coded sections	**Subcategories**	**Categories**
"We paid attention that the [acquired solution] can be easily integrated in our platform.[1)] There are often scenarios, when a customer or a partner says, [the acquired solution] is great, but there is a certain piece missing. […] then you need some kind of platform that allows them to fill this gap[2)]. This is always our biggest selling point, that we can say we have integrated [the acquired solution], with our platform, you can use it in an easier way.[3)]"	1) Integration of acquired solutions 3) Benefit of acquiring solutions	Acquisition
	2) Customer adding functionality to the software 3) Platform facilitates additions by customers	Customer enablement
"[…] we continue to be the developer of the application, but it is marketed as [IS-Corp-]branded product[4)]. [IS-Corp] sells the software not as [third-party application], but just as if it was an [IS-Corp] software. […] Since this is happening, revenues with [IS-Corp] have increased steadily.[5)]"	4) Marketing third-party product under *IS-Corp* brand	Branding
	5) Partner revenue increase	Positive effect on value co-creation

Table 3: Illustration of the Coding Scheme

Findings and Interpretation

The analysis and interpretation of our interview data helped us, first, to confirm that the *IS-Corp* platform contributes to value co-creation and capture. Second, we analyze the interview partners' views on value capture. Combining and interpreting these views leads to the emergence of three mechanisms of value capture implemented on the platform. Third, we are able to further interpret the interaction effect of the value capture mechanisms on value co-creation.

IT Platform Supporting Interfirm Collaboration

Our findings first confirm that collaboration with partners on the IT platform is key to *IS-Corp's* business. The enterprise software product we focus on is extended by various applications developed by partners. This collaboration is a *"win-win situation"* for both *IS-Corp* and its partners, as interview partners form both sides confirmed. Partners help *IS-Corp* to offer end-to-end solutions for customers across industries and countries. Specialized third parties can provide offerings that require specific knowhow or address a relatively small niche market in a more efficient way.

In addition, the partners benefit from collaborating with *IS-Corp* on the IT platform, by gaining access to the large market that *IS-Corp* has been addressing with its enterprise software. Application partners do not need to set up worldwide sales channels; they can directly market their application to *IS-Corp's* installed base and to new customers via the *established* sales channels. Thereby, they also benefit from *IS-Corp's* positive image for reliable software solutions. On the technological layer, the collaboration of *IS-Corp* and its partners is enabled by an increasingly open architecture that provides APIs and is based on common programming languages. One interview partner of *IS-Corp* states:

> *"[IS-Corp] attracts partners relatively easy. As of today, we have several hundred partner applications running – probably even more – [developed by] application providers from different segments. This is a relatively steep growth curve, [the number of] our partners. This is also related, for example, to our shift from a solution that was coded in [proprietary language] and now is designed much more open with Java. Deploying and integrating your applications with Java is significantly easier now."*

Thus, while in earlier versions of the software product few strategic partners developed deeply integrated extensions to the core system, with the new *IS-Corp* platform, numerous platform partners can develop extensions with significantly less effort. The product manager refers to the platform as the *"innovation layer for the traditional, rather slow ticking systems of [IS-Corp]."* He further describes that *IS-Corp* had initially focused on value co-creation, aiming at enlarging the network of third-party developers and the number of available solutions:

> *"You have to make the pie bigger by bringing more partners on the platform and by thinking about new use cases, scenarios, or applications that are not covered yet."*

However, it is not just the size of the pie that determines the success of the platform project, but also the share of the pie that *IS-Corp* can claim. Whether an organization is successful with a digital business strategy such as the implementation of an IT platform depends on both a flourishing ecosystem for value co-creation and a suitable approach for value capture. In the context of the *IS-Corp* platform, there are no longer contractual agreements on value sharing as it was the case in dyadic partnerships. Value co-creation is not automatically associated with value capture. Consequently, the product manager sees a deficit despite an increasing number of third-party extensions: *"If you also consider the revenue [of the IS-Corp platform], we lack behind. We should have come further. Are there initiatives [to improve that]? Yes."* We discuss the initiatives that *IS-Corp* has taken to improve the value captured from its platform in the next section.

Mechanisms of Value Capture

In the course of the analysis and interpretation of the interview partners' views on value capture, three mechanisms of value capture emerged: (1) absorption, (2) co-selling, and (3) verticalization. Each mechanism becomes manifest in different actions of value capture as summarized in Table 4. While these manifestations directly result from the analysis of the interviews, the three mechanisms are a result of our interpretation of the findings.

Mechanism	Description	Manifestations
Absorption	The platform owner extends the product portfolio by providing complementary applications or functionalities that formerly were offered by third parties.	• Acquisition of third-party applications or the firms behind the applications • Imitation of third-party applications • Extension of the platform's core offering covering functionalities previously provided by third parties
Co-selling	The platform owner engages in joint activities with third-party developers to support them in selling their applications.	• Bundling of third-party applications and platform • Branding & certification of third-party applications • Customer enablement to support customers in marketing applications they developed for their own use
Verticalization	The platform owner defines and, together with partners, implements dedicated vertical use cases on the platform.	• Industry verticals to address specific industries with a pre-defined set of platform functionalities and third-party applications • Front-runners to illustrate the platform's potential in industry verticals early on

Table 4. Mechanisms of Value Capture

The mechanism **(1) absorption** refers to activities *IS-Corp* engaged in to directly offer complementary applications to end-users that previously had been provided by third-party developers. As *IS-Corp* absorbs these applications, it can claim the full revenue resulting from the applications' sales, instead of sharing the revenue with third-party developers. The mechanisms of absorption emerged from our data, as our interview partners mentioned diverse actions related to absorbing complementary applications. We grouped these actions into three main manifestations, which we describe in more detail below: acquiring third-party applications (or the firms developing the applications), imitating other third-party applications or extending the core of the platform with functionality previously provided by third-party applications.

IS-Corp has acquired a number of firms whose products it now offers as complementary applications on the *IS-Corp* platform. These firms did not necessarily have a complementary application on the platform before the acquisition, but they had products *IS-Corp* could transform into complementary applications. For example, *IS-Corp* bought a firm that offers solutions for human resource management. By acquiring the firm and moving the solutions on the *IS-Corp* platform, *IS-Corp* increased the number and variety of applications available on its platform. The absorption of these applications therefore has a direct and an indirect effect on value capture. The direct effect results from the applications' sales on the platform that accrue to *IS-Corp* entirely. The indirect effect results from an increased number of innovative applications that make the platform more attractive. The project lead of the platform project illustrates the potential of carefully chosen acquisitions that *IS-Corp* subsequently makes available on the platform:

> *"We paid attention that the [acquired solution] can be easily integrated in our platform. There are often scenarios, when a customer or a partner says, [the acquired solution] is great, but there is a certain piece missing. [...] then you need some kind of platform that allows them to fill this gap. This is always our biggest selling point, that we can say we have integrated [the acquired solution] with our platform, you can use it in an easier way."*

From *IS-Corp's* experience, it is easier to acquire a firm that provides a complementary application on the platform than a firm whose product is going to be integrated into *IS-Corp*'s core product. The firm with a complementary application can run relatively autonomously after the acquisition, acting like an independent third-party developer. This reduces typical frictional losses that occur when the new parent company quickly integrates acquired firms.

> *"Usually, you let [the acquired firms] run autonomously for a certain time. [...] Otherwise, you destroy all the advantages you gain from acquisitions. Just as [anonymized company]. They are still quite autonomous and they have been with us for several years – and still have high degrees of freedom."*

Besides acquiring complementary applications, we identified two less explicit strategies of absorption: imitating existing applications and integrating parts of their functionality in the platform's core offering. Similarly to acquisition, both actions affect value capture directly, by generating revenue that does not need to be shared and indirectly by strengthening *IS-Corp's* position in the competition. One of *IS-Corp's* partner managers states the importance of the own core offering on the platform:

"Internally, it is fact that innovative and promising applications on the [IS-Corp platform] often are generated by us."

By engaging in **(2) co-selling**, *IS-Corp* collaborates with third-party developers in joint sales activities. This collaboration goes further than just offering the third-party applications on the app store of the platform. The goal of joint sales activities is that *IS-Corp* helps to increase the third-party applications' sales and, in turn, claims a larger share of the revenue. Therefore, co-selling activities potentially increase *IS-Corp's* value captured from the platform ecosystem. Interview partners from both *IS-Corp* and partners highlighted the benefit of joint sales activities. We grouped the specific actions taken to leverage joint sales activities for value capture into three facets of co-selling: bundling, branding and certification, and customer enablement.

Bundling refers to deals in which end-users purchase a bundle consisting of the platform and one or several applications. Bundling is particular important in a B2B context. Most sales deals are closed because of direct interaction between the sales team and the end-user – despite most applications being available in the platform's app store. As the platform alone is not relevant for most customers, *IS-Corp* needs to suggest a suitable combination of platform and apps to the customers:

"There are always these cross-selling and bundle deals where we sell some kind of standard product which generates considerable revenue for the sales guy. We realized that with regard to the [IS-Corp platform]: in the beginning, we did not tell the [platform] story right. We did have a marketplace and all, but that just didn't work for our company, just because our customers do not buy on an online marketplace. Instead, they have their person of trust in our sales team, whom they have confidence in, whom they buy bundles from. [...] There's our sales guy saying `dear [customer], I offer you these three packages and if you take the fourth, it's 50% off.´ That's how our deals are closed."

Most third-party developers would not be able to sell their applications as much, if it was not for *IS-Corp* and its sales teams. As a result, *IS-Corp* can claim a substantial share from the revenue generated through third-party applications in such bundle deals, increasing its value captured form the platform ecosystem.

As further facet of co-selling, branding and certification sparked our interest. By branding, we refer to complementary applications of the platform that were developed by third parties but are marketed under the *IS-Corp* brand. Branding does not entail that third-party developers did subcontracted development for *IS-Corp*. Instead, once the third-party developers approached *IS-Corp* for marketing their applications, both concluded that marketing the application under the *IS-Corp* brand is most beneficial. The reason could be that the third-party developers need endorsement by the *IS-Corp* brand, as not all end-users know them. At the same time, *IS-Corp* sees the advantage of remaining visible to the end-user as provider of the front-end functionality. By marketing applications under its own brand, *IS-Corp* guards against being seen as pure technology provider while others offer the innovative applications on top of the technology.

Certification is similar to branding but does not go as far. Instead of rebranding the third-party applications, *IS-Corp* certifies them and labels them accordingly. Again, the motivation for third-party developers is to benefit from *IS-Corp's* image and from its extended support in sales activities for certified applications. *IS-Corp* can increase its value capture through certification in a twofold way. First, third-party developers pay for being certified, creating direct revenue for *IS-Corp*. Second, certified applications are increasing the overall sales of applications as end-users are more likely to trust them. Therefore, the value captured through revenue share also increases for *IS-Corp*.

A third facet of co-selling we observed is customer enablement. By customer enablement, we understand supporting customers to develop and subsequently market an application that the customers need for their own use. Many firms that are end-users of *IS-Corp's* enterprise software use the platform to develop applications for their own purposes, for example, to analyze data sets that only result from processes in a specific industry and have specific characteristics. The product owner of the *IS-Corp* platform illustrates:

"One of our largest and dearest customers by now has developed four applications on [our platform]. They built a CRM application, on [our platform], they built a call center application, on [our platform] - as extensions to their on-premises system. They were one of the firsts to do so."

IS-Corp does a lot to enable these customers to develop the applications they need. For example, *IS-Corp* offers trainings on how to use the platform to develop individual applications or consults customers on specific projects. *IS-Corp* has started to evaluate whether some of these applications developed by customers were relevant for other customers as well and could thus be marketed on the platform. To do so, *IS-Corp* needs to enable the customer to develop the application in a generic way so that it can be white-labelled and sold to others. *IS-Corp* would increase its value captured beyond the fees the customer pays for using the platform by generating additional revenue through white-labelled customer applications.

(3) Verticalization refers to the platform owner defining and implementing dedicated vertical use cases on the platform to increase the platform's acceptance among customers. The *IS-Corp* platform is of horizontal nature, following the basic idea of a platform to support applications for various use cases. However, in a B2B context, generating solutions for specific use cases based on a horizontal platform is challenging. For example, in equipment manufacturing, a heterogeneous machine outfit combined with complex processes leads to specific requirements for the platform and its extensions. It is unlikely that generic applications designed for the horizontal platform will fulfill these requirements.

To address this challenge, *IS-Corp* defines specific industry use cases, i.e., "industry verticals" that bring together the stakeholders involved in such complex processes. For example, *IS-Corp* connects the manufacturers of the machines used at the customer sites for production as well as application partners that are able to provide suitable analytics applications. *IS-Corp* consults the stakeholders of the industry verticals on how they can leverage the platform to develop applications useful for the specific industry. The project lead of the platform describes one particular initiative for an industry vertical:

> *„At [our customer] we have an application, [our customer] is using it, it analyzes vibration of machinery, meaning, the different machines are connected via [our platform], provide measurement data and, based on this data, conduct vibration analyses to anticipate outages of the machines. And then you can schedule maintenance even before the outages occur, that's an easy way to reduce costs, minimize maintenance costs and minimize downtime"*

By creating dedicated industry verticals, *IS-Corp* unlocks new markets for its platform that are considered too specialized to benefit from a horizontal platform. As *IS-Corp* is initiating these industry verticals, it is in a good position to claim a considerable share of the revenue generated from the applications within the verticals. While creating a vertical requires some upfront investments, selling them to several end-users will soon lead to profits due to economies of scale.

Closely related to the manifestation of industry verticals are front-runners. Front-runners are third-party developers that provide complementary applications as early as the start of the IT platform or of a dedicated industry vertical. On the one hand, those front-runners can be existing strategic partners of *IS-Corp*. Ideally, these strategic partners are reputable in their respective industry and thus incentivize others to also contribute applications to *IS-Corp* platform. One external partner of *IS-Corp* describes this signaling effect:

> *"[…] just like Netflix when, at the time, they used Amazon for their [streaming service]. It is important that there are other companies, renowned firms, that use the service, that illustrate the use case."*

On the other hand, large strategic partners may be relatively slow and might not come up with the most innovative solution for the start of the platform. Collaboration with smaller partners as front-runners can therefore also be beneficial, as the product owner of the platform states:

> *"What you need is indeed some kind of front-runners that, in the end, influence others to copy their moves. And that's why [IS-Corp] would be ill-advised to only collaborate with large strategic partners on the platform. Instead, we also […] conduct co-innovation with smaller partners early on."*

Front-runners are therefore essential for *IS-Corp* not only at the launch of the platform but also at the launch of industry solutions such as the *IS-Corp* platform for the Internet of Things (IoT). They demonstrate the potential of the platform for others, thus *IS-Corp* is in a good position to establish a beneficial revenue sharing model already from the beginning. Taken together, verticalizing the horizontal platform has the potential to create new revenue streams from which *IS-Corp* can claim a substantial share.

Interaction Effects on Value Co-creation

The insights on the mechanisms of value capture – absorption, co-selling, and verticalization – cannot be presented without discussing their interaction effects on value co-creation. Value capture can have reinforcing and alleviating effects on value co-creation, which would then require a careful balancing between increasing value co-creation and smothering value capture. By interpreting our findings, we suggest interaction effects of the three mechanisms with value co-creation as summarized in Table 5.

Mechanism	**Interaction Effect on Value Co-Creation**	**Illustration**
Absorption	**Negative (-):** As the platform owner absorbs complementary applications from third parties, their incentives to contribute further complementary applications are decreased.	*IS-Corp* has acquired several companies in the areas of procurement and human resource management, whose products are moved onto the platform. This restricts the potential value co-creation in those areas.
Co-selling	**Positive (+):** As the platform owner supports third-party developers in their sales activities through different facets of co-selling, their incentives to contribute further complementary applications are increased.	Several partners of *IS-Corp* have stated increasing revenues due to co-selling activities, leading to an overall positive effect on value co-creation in the ecosystem.
Verticalization	**Neutral (o):** As the platform owner creates dedicated industry verticals, new areas for value co-creation are made accessible. At the same time, the increasing specialization in verticals shrinks the target group, decreasing third parties' incentives to contribute further complementary applications.	*IS-Corp* provides industry-specific solutions, for example for the manufacturing industry. Value co-creation takes place with partners, for example for applications to manage tooling of machines. This specialization entails limited co-creation opportunities across use cases on the platform.

Table 5. Mechanisms of Value Capture and Their Interaction Effect on Value Co-creation

First, we suggest that the mechanism of absorption in general has a negative impact on value co-creation. To establish sustainable value co-creation activities on a platform, incentives for third-party developers are necessary. Commonly, the main incentive for third parties to develop applications is that they can reach a large number of platform users with far less effort compared to a situation where they would need to market their software product on their own. Even though in the case of *IS-Corp* the addressable market is smaller than in many B2C platform markets (e.g., smartphone operating systems and their mobile applications), being able to sell applications to all of *IS-Corp's* customers is a promise of high returns for many third-party developers.

However, if *IS-Corp* internalizes successful or promising third-party applications to claim the full revenue, this can negatively affect the third-party developers' motivation. In particular, if *IS-Corp* imitates third-party applications or extends the functionality of the platform core making third-party applications redundant, third-party developers incentives are decreased. While *IS-Corp* is currently in a good position to attract third-party developers due to its market penetration, increasing absorption activities may negatively affect value co-creation in the long run. For example, *IS-Corp* has acquired several companies in the areas of procurement and human resource management in the recent years, whose products have in parts been moved onto the *IS-Corp* platform. Thereby, major areas for value co-creation are restricted, reducing third-party developers opportunities and, as a result, their incentives to further contribute to the platform ecosystem.

Second, we interpret co-selling as a value capture mechanism that positively affects value co-creation. Co-selling does not only increase *IS-Corp's* potential for value capture. At the same time, the overall revenue that is generated through third-party applications increases, leading to more revenue that accrues to the third-party developers. Even if *IS-Corp* claims more of that value than without co-selling activities, there can be a positive net effect for the third-party developer that incentivizes other third-party developers to co-create value. The net effect the third-party developer benefits from is dependent on the conditions imposed by *IS-Corp*. For example, if *IS-Corp* claims an unreasonably high share for selling an application under the *IS-Corp* brand, third-party developers will not engage in co-selling. Customer enablement as further facet of co-selling creates potential for value co-creation that had not been visible before. Again, the conditions for value capture by *IS-Corp* need to be reasonable, then customer enablement will not only increase value capture but also value co-creation.

Third, we suggest that verticalization does not have a clear positive or negative interaction effect with value co-creation. On the one hand, dedicated industry verticals create new areas in which value co-creation can take place. By bringing different stakeholders of an industry vertical together, value co-creation emerges, that would not have happened on the horizontal-only platform. On the other hand, a platform that is dominated by a number of industry verticals represents a fragmented platform that requires specialized applications for different uses cases. For third-party developers, there would be no longer a substantial difference to developing dedicated software solutions for an industry without using the platform. For example, *IS-Corp* provides industry-specific solutions for the manufacturing industry. Value co-creation takes place with partners, for example for applications to manage tooling of machines. This specialization entails limited co-creation opportunities across use cases on the platform. Consequently, *IS-Corp* aims at targeting medium-sized customers with the horizontal part of the platform with applications that are more generic and, in addition, implementing industry verticals for industries with large players. In this combined strategy, verticalization should not have an overall negative effect on value co-creation.

In sum, the mechanisms of value capture can have both positive and negative effects on value co-creation. *IS-Corp* is balancing the implementation of value capture mechanisms and their interaction effects with value capture.

Discussion and Conclusion

In this section, we provide a summary of the mechanisms of value capture we have identified to enhance our theoretical pre-understanding on value capture. We then discuss the mechanisms derived from our case study with regard to IT platforms in general. Based on this discussion, we show implications on the debates of platform openness and performance of digital business strategies.

Tuning Value Capture in IT Platforms

Based on the explorative case study, we identified absorption, co-selling and verticalization as mechanisms of value capture. Absorption includes measures taken by the platform owner such as acquiring third-party applications, imitating successful third-party applications, or incorporating functionality into the platform core that was previously provided by third parties. Co-selling refers to sales activities in which the complementor is involved including bundling, branding and certification or enabling customers to market applications they have developed for their own use. Verticalization includes measures taken to create industry-specific use cases together with third parties that are then marketed in the respective industry. These mechanisms of value capture can in turn affect value co-creation. While we interpret absorption to negatively affect value co-creation, we suggest that co-selling has a positive impact and verticalization does not have a clear positive or negative effect on value co-creation. Our findings are summarized in Figure 3, enhancing our theoretical pre-understanding of value capture in IT platforms.

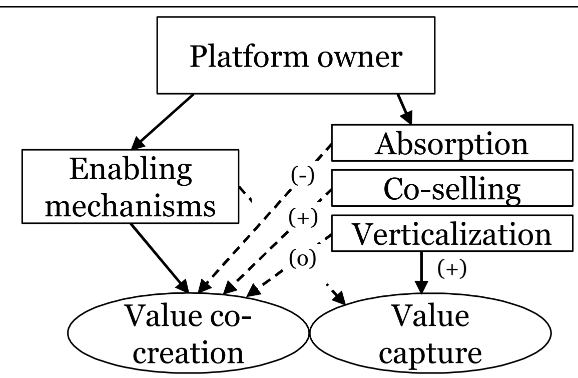

Figure 3. Revised Theoretical Understanding of Value Capture in IT Platforms

The insights on value capture that emerged in our case study contribute to our theoretical understanding of how the platform owner captures value in IT platforms. The mechanism of absorption has already been discussed in literature on B2C IT platforms. Platforms such as Microsoft's Windows have, over time, incorporated functionalities that previously had been provided by third-party developers (e.g., music player or instant messaging) (Eisenmann et al. 2009). With our findings, we not only confirm that absorption is also relevant in a B2B context but we show different manifestations of absorption and discuss the repercussion effect on value co-creation. Our interpretations therefore make a tradeoff explicit that is implicitly visible in previous work (Eisenmann et al. 2009; Eisenmann et al. 2011): absorption has a positive effect on value capture but may have negative consequences for value co-creation. Absorption has to be applied with caution and is contingent on the platform owner's position vis-à-vis the complementors. The more attractive the platform ecosystem is the less harmful absorption activities will be.

The mechanism of co-selling integrates fragmented insights on bundling and new insights on branding, certification, and customer enablement into one concept of value capture. Bundling has been shown to help platform owners with market power to claim more from the available surplus (Eisenmann et al. 2009; Rochet and Tirole 2005). We enhance this view by showing that bundling is in fact a co-selling activity of the platform owner and complementors and thus can have a positive effect on value co-creation in addition to benefits for value capture. Branding and certifications are measures that are rooted in models of B2B partnerships that have existed before IT platforms have become prevalent (Ceccagnoli et al. 2012; Sarker et al. 2012). We show that they are also beneficial in the context of IT platforms, thus established companies may benefit from their experience in these partnership models when implementing an IT platform strategy.

The mechanism of verticalization introduces a new notion of value capture in research on IT platforms. Verticalization does not go as far as vertical integration, where the platform owner would integrate complementary applications and close off the platform (Parker et al. 2017). By applying verticalization, the platform, while remaining horizontal, is enriched with vertical use cases for specific industries. This approach is particularly useful for technologically complex platforms that comprise several layers, such as a device or machine layer, a data layer, a micro-service layer and an application layer. Many B2B IT platforms exhibit such complex architectures, for example in the area of IoT. For those platforms, the mechanisms of value co-creation and capture previously established in research are not fully applicable as the complexity impedes network effects. Verticalization is one way to nevertheless benefit from the economies of scale an IT platform can yield.

In sum, we first illustrate that value capture is a crucial element of any IT platform strategy. This finding contributes to literature on IT platforms as existing work focusses predominantly on value co-creation (e.g., Boudreau 2010; Eaton et al. 2015; Ghazawneh and Henfridsson 2013). Value capture thereby goes beyond the aspects discussed in literature such as pricing (Hagiu 2006; Tiwana 2014) and bargaining (Oh et al. 2015). To capture value, platform owners can leverage a set of diverse mechanisms and our study gives a first impression of what shape these mechanisms can take. Second, we show that understanding the interaction effect of value capture and value co-creation is crucial for the success of IT platforms. We contribute to discussions in management and IS literature on the relation of value creation and value capture (e.g., Bharadwaj et al. 2013; Lepak et al. 2007; Priem 2007) by providing examples how distinct mechanisms of value capture affect value co-creation. Considering these interaction effects helps to avoid enforcing value capture when it is harmful to co-creation or to recognize that the gains in value capture will overcompensate losses in value co-creation.

Value Capture and the Debate of Platform Openness

Results on value capture inform the debate of how open IT platforms should be designed towards complementors (vertical openness) (Benlian et al. 2015; Boudreau 2010; Ondrus et al. 2015; Thomas et al. 2014). The debate revolves around choosing the right degree of openness to balance the tradeoff between diversity and control (Benlian et al. 2015; Boudreau 2010). A high degree of openness supports a high quantity and variety of complementary applications but comes along with reduced possibilities to control the activities and outcomes in the platform ecosystem. Vice versa, strict control is implemented to ensure quality and other standards but, in turn, reduces the platform's openness and thus its generativity.

The mechanisms of value capture that we identified affect the platform's openness or at least the perceived openness from the complementors' viewpoint. For example, absorption activities will make the platform appear more closed as the platform owner restricts the degrees of freedom of the complementors. Even if the platform, on a technical basis, remains open to anyone, absorption can lead to a more restricted platform ecosystem. Capturing value through verticalization will make the group of possible complementors smaller, as more specialized complementors are to address a smaller market compared to a platform without verticalization strategy.

The decrease in perceived openness may lead to performance losses of the platform ecosystem as a whole (Benlian et al. 2015; Ondrus et al. 2015). Therefore, platform owners need to align the mechanisms of value capture they apply with their strategy regarding openness and control. For example, occasional absorption might not be harmful in large and open ecosystems. Google imitated several third-party applications on Android such as an internet browser or maps and navigation. Due to the ecosystems size and openness, this did not affect the value co-creation taking place in the ecosystem.

At the same time, implementing a strategy for openness and control needs to be viewed in front of possible effects on value capture. Boundary resources contribute to a platform's openness as they support complementors in developing applications (Eaton et al. 2015; Ghazawneh and Henfridsson 2013). They directly support value co-creation but the provision and maintenance can be costly – costs that impede value capture. Similarly, control is necessary to a certain degree to ensure the quality of complementary applications (Boudreau 2010; Goldbach and Benlian 2015). The importance of control is even bigger in B2B IT platforms as the applications can be relevant for critical business processes. However, strict control cannot only impede value co-creation, it is also costly, and thus impacts value capture negatively. In sum, the debate of openness benefits when one keeps in mind that the balance of openness and control is also impacted by the value capture strategy that the platform owner takes on.

In practice, despite the potential of IT platforms being emphasized for years (e.g., Boston Consulting Group 2016; Capgemini 2016), many firms struggle to set up an IT platform from which they capture a sufficient share of the co-created value (Bharadwaj et al. 2013; Rietveld et al. 2016). One reason might be that when designing openness and control of the platform the focus lies too much on facilitating value co-creation at the expense of value capture. Our findings help practitioners to consider their options for value capture early on and design the IT platform with the corresponding degree of openness. As we observe more and more initiatives to establish B2B IT platforms for example in the Internet of Things, we hope that these platforms in particular benefit from our considerations.

The Performance of Digital Business Strategies

We furthermore contribute to the discussion on the effect of digital business strategies on the performance of firms (Bharadwaj et al. 2013; Rai and Tang 2014). The challenge of value capture is not limited to IT platforms but arises in other digital business strategies, such as digitally integrated supply chains in manufacturing or customer-centric digital provision of services in banking (Setia et al. 2013). The basic challenge remains the same: Value is co-created in interfirm networks with partners and the focal firm needs to capture a sufficient share. While existing research acknowledges that the interplay of both value co-creation and capture determines market performance (Rai and Tang 2014), the source for value co-creation and capture are not well understood (Bharadwaj et al. 2013).

In our study, we focused on the example of IT platforms as digital business strategy but most of the digital business strategies comprise complex interfirm networks (Nalebuff and Brandenburger 1997). Thus, the mechanisms of value capture we identified can be, to a certain degree, applied in other settings. For example, absorbing products or firms that improve the IT integration capabilities within a supply chain is likely to help the focal firm to capture value from the supply chain's co-created value. In a customer-centric interfirm network for digital service provision, co-selling with network partners can be crucial for success. Without co-selling, it will be difficult to enable a seamless customer experience for heterogeneous customer groups across different platforms (Setia et al. 2013).

Our results enrich and substantiate existing general insights on value capture in digital business strategies. For example, Rai and Tang (2014) identify bundling, lock-in and barriers to imitation as mechanisms for value capture in IT-enabled business models. Our focus on value capture within the interfirm network adds to these mechanisms, which are routed in competition among firms. This broadened view on value capture is also relevant for strategic management research and its shift from the resource-based view to the relational view of the firm. As we illustrate, not only the locus of value creation has changed from firms possessing and generating inimitable resources to value co-creation within interfirm networks – also value capture has to be viewed as extracting value from a network of partners in addition to extracting value from a market.

In practice, establishing digital business strategies is an ongoing challenge across industries. While our results will not solve the challenges firms face in the digitization, they make practitioners aware that value capture is as central element of a digital business strategy. The mechanisms of value capture we derived in the context of IT platforms provide starting points how value can be captured in other digital business strategies.

Limitations and Future Research

Our study is subject to limitations. First, we interpret value capture as claiming parts of the value that is co-created within the platform ecosystem. At the same time, value capture can be understood as extracting value from a market, i.e., disputing value from competitors (Tiwana 2015). This perspective leads to strategies such as platform envelopment (Eisenmann et al. 2011) and breaching (Ozer and Anderson 2015). We acknowledge that for a comprehensive understanding of an IT platform's success, both views on value capture need to be considered. Yet, the view on value capture within the platform ecosystem has been underrepresented in extant literature. Second, it is inherent to single case studies that generalizing the results is challenging. For example, we have derived our results from a platform in the B2B context, thus they cannot be taken for granted for large scale B2C platforms. We have taken these considerations into account when discussing the generalizability of the results.

We finally suggest two avenues for future research that have emerged during our work, which we could not address within the scope of this study. First, it would be worthwhile to analyze the application of value capture mechanisms and their interplay with value co-creation mechanisms across different platforms and over time. Within such a multiple case study, promising configurations of value capture mechanisms could be identified, contingent on the platforms' specific background (El Sawy et al. 2010; Fiss 2007). Second, during our study, themes related to the IT capabilities required to implement value capture mechanisms emerged. Analyzing empirically which IT capabilities firms need to possess or to develop in order to benefit from their IT platform would enhance our understanding of value capture in IT platforms and contribute to the ongoing discussion of IT capabilities for digital business strategies (e.g., Rai and Tang 2010).

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Governing Nonprofit Platform Ecosystems – An Information Platform for Refugees

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The number of refugees arriving in Europe increased dramatically in 2015. Following arrival at the host country, refugees need access to information on various topics such as applying for asylum, medical care, educational offerings, jobs, or social activities. As many different parties using different channels provide this information, refugees struggle to access relevant information at the right time. Our goal in addressing this information deficit is to support a digital information platform for refugees by developing a governance strategy for the ecosystem of information providers. Within an action research study based on a nonprofit project, we evaluate the implementation of governance mechanisms derived from platform and community governance literature. Our results show that governance mechanisms are implemented differently for nonprofit platform ecosystems than for commercial platform ecosystems. These results enhance the societal impact of the information platform developed in the project. The study contributes to theory on governance of platform ecosystems and IT-enabled collaboration by evaluating established governance mechanisms in the context of nonprofit platforms.

Keywords: Consultation and collaboration across digital differences; eGovernance for good government (eGovernment and eBusiness); Open sourcing; Online communities; IT platform; platform governance

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Introduction

The world has faced a refugee crisis since 2015. In the first half of 2015, the number of refugees under the UNHCR (United Nations' Refugee Agency) mandate reached 14.4 million and increased further in the second half of the year (UNHCR, 2015). The regions of origin of the refugees are conflict-affected countries in the Middle East (e.g., Syrian Arab Republic, Afghanistan) and Africa (e.g., Somalia, Sudan, South Sudan). While the majority of refugees are hosted by neighboring countries, an increasing number has sought asylum in European countries. Approximately 1.26 million refugees applied for asylum in the European Union in 2015, the highest number of asylum seekers since the existence of the EU (Eurostat, 2016).

Upon arrival, refugees not only need to be supplied with necessities such as medical care, food, shelter, and adequate clothing for local weather conditions, they also need information on, for example, how to obtain medical care, how to initiate the asylum process, how and where to participate in language courses, or how to engage in activities with local residents (Qayyum, Thompson, Kennan, & Lloyd, 2015). Unfortunately, relevant information for refugees is collected and distributed by a large number of different sources. Various governmental agencies, non-governmental organizations (NGOs), local initiatives, and volunteers provide parts of the relevant information – albeit using an often-uncoordinated effort. To complicate matters, the information varies from municipality to municipality and becomes outdated quickly due to regulatory amendments or other changes. In counseling programs for asylum seekers, agencies and volunteers try to bundle the most important information, typically by gathering brochures and flyers, and enrich this printed information with their personal experience. While this effort is extremely important and helpful, it may not be the optimal method to disseminate relevant information: brochures may get lost, content may become irrelevant with time or no longer applicable when refugees are relocated, and information relayed orally may be forgotten or misunderstood.

IT can help to overcome this information deficit. First, IT facilitates the collaboration of different actors to produce information (Brown, Scott Poole, & Rodgers, 2004; Cheng & Yu, 2015). Therefore, IT could help different actors to collaboratively collect and edit relevant information for refugees. Second, IT enables the timely and efficient presentation of context-specific information (McKinney & Yoos, 2016) and thus could help to provide refugees with relevant information via a digital channel. As the vast majority of refugees has a smartphone at their disposal (see also the discussion by O'Malley in The Independent, 2015) , information can be communicated via mobile applications as a digital channel. Going beyond that, studies have shown that IT can help to promote social inclusion by allowing refugees to participate in an information society, to communicate effectively despite language barriers, and to better grasp the nuances of the society they have entered (Andrade & Doolin, 2016; Caidi, Allard, & Quirke, 2010; Schreieck, Wiesche, Hein, & Krcmar, 2016).

Given the challenge that information intended for refugees is heterogeneously distributed among different sources and varies from municipality to municipality, an IT-enabled collaboration platform could help to integrate both general and location-specific information for different municipalities. On an IT-enabled collaboration platform, the information provider acts as a complementor by contributing information to the platform, and the refugee acts as a user by consuming this information (Ghazawneh & Henfridsson, 2013). The platform itself acts as intermediary, bringing both sides together (Majchrzak, Markus, Wareham, 2016).

Applying platform governance helps to incentivize complementors to participate in platforms and to manage their contributions. As shown for different commercial platforms, platform governance mechanisms cover, for example, the degree of openness of a platform, control mechanisms like quality checks, or boundary resources such as standardized application programming interfaces (APIs) to enable developers to access the platform (Tiwana, 2014).

Combining these and further governance mechanisms stimulates third party contributions (Manner, Nienaber, & Schermann, 2013).

Existing insights on the governance of commercial digital platforms may not be applicable to nonprofit platforms. In commercial platform ecosystems, the platform owner implements governance mechanisms to manage co-creation of value to capture as much of the generated value as possible (Gawer & Cusumano, 2008). In nonprofit platform ecosystems, governance is applied to increase the societal impact of the co-created value and the platform as a whole. Therefore, the underlying strategic goal is not to incentivize the information provider monetarily but to engage them morally in a societal context. Given this situation, the application of platform governance has not, to the best of our knowledge, been discussed. Addressing this gap, we pose the research question: *"How can governance mechanisms be applied to stimulate third-party contribution in nonprofit platform ecosystems?"*

To answer this question, we analyze the application of governance mechanisms on an information platform for refugees within an action research study. We conducted the study within a nonprofit project dedicated to the implementation of an information platform for refugees. At the time of the study (October 2015 – March 2016), the platform had already been used in several municipalities of a European country. Based on governance mechanisms derived from platform governance and community governance literature, the researchers configured governance strategies that were evaluated during two cycles of the action research study. As a result, a sustainable governance strategy was developed that supported onboarding of information providers and ensured their motivation to keep the information updated. Our results provide guidance on how to set up a nonprofit platform governance. In addition, the discussion of the results contributes to IS research in the field of platform governance as part of the literature on co-creation of value for societal impact.

Our study contributes to recent literature in a threefold manner. First, we discuss the application of platform governance mechanisms within a nonprofit context, contributing to literature on IT platforms. Second, we enrich knowledge on IT-enabled collaboration within communities given the fact that the community consists of distributed voluntary workers. Third, our findings relate to research that analyzes how information and communication technologies support social movement organizations in general (Selander & Jarvenpaa, 2016) and in the specific context of refugees (Andrade & Doolin, 2016). Our findings are also of interest for practitioners in social movement organizations and for those involved in e-government projects, i.e. projects that provide government services to citizens via digital channels (Adeleke & AbdulRahman, 2011; Balta, Greger, Wolf, & Krcmar, 2015; Kuk & Janssen, 2013). The governance strategies we developed might help these practitioners to improve the IT-enabled collaboration in their projects.

In the remainder of the paper, we first present related work from platform and community governance, deriving a set of relevant governance mechanisms. After describing the method of action design research, we picture the project, which serves as a testbed for the development of governance strategies. We then describe the results of the study that yielded a suitable governance strategy. Finally, we discuss the implications of our study.

Theoretical Background

An information platform for refugees can only unfold its societal impact if heterogeneous information providers collaborate on the platform. The collaboration between information providers is IT-enabled, i.e. supported by an IT platform. Through collaboration on the platform, the information providers co-create value and need to be governed such that the co-creation of value is maximized (Grover & Kohli, 2012). To review our current understanding of governance in platform ecosystems and IT-enabled collaboration communities, we review and integrate literature from both areas.

Value Co-Creation through Platform Ecosystems

IS research has acknowledged the role of IT in enabling co-creation of value in the development and commercialization of technologies (Boudreau, 2010; Nambisan, 2013). In particular, digital platform ecosystems foster innovation, software development, and the provision of services (Schreieck, Hakes, Wiesche, & Krcmar, 2017; Schreieck & Wiesche, 2017). In a broad sense, platforms can be defined as “foundational products, services, or technologies upon which additional complementary products, services or technologies can be developed” (Gawer, 2009). If a platform is open to the outside (“external platform” versus “internal platform”), the additional complementary products, services, or technologies are developed by third parties as part of a co-creation of value process. As a result, an ecosystem of complementors is created around the platform. We understand platform ecosystems as “a set of actors functioning as a unit and interacting with a shared market for software and services, together with the relationships among them” (Jansen, Brinkkemper, & Finkelstein, 2009).

The process of co-creation of value has been analyzed for a plethora of digital ecosystems. A large part of the literature discusses application platforms for handheld computing systems such as Google Android and Apple iOS (e.g., Benlian, Hilkert, & Hess, 2015; Eaton, 2015; Liu, Au, & Choi, 2014). Further investigations of co-creation of value for digital ecosystems cover gaming platforms such as PlayStation and Xbox (Lin, Li, & Whinston, 2011), e-commerce platforms such as Alibaba (Koh & Fichman, 2012), and digital content platforms such as YouTube or Amazon Kindle (Lusch & Nambisan, 2015). All these examples show how co-creation of value can enhance the success of a commercial platform.

Co-creation of value through platform ecosystems has not yet been analyzed for social causes. While the role of IT to support nonprofit projects has increasingly received attention in IS research (e.g., Andrade & Doolin, 2016; Selander & Jarvenpaa, 2016), digital platforms and their potential for social causes are often neglected. By enabling co-creation of value, digital platforms can bundle the knowledge and experience of different actors involved in a nonprofit project. In the case of an information platform for refugees, municipalities, private initiatives, and other providers of information collaborate on the digital platform to collect, condense, and attractively present relevant information for refugees. Not surprisingly, co-creation of value through digital platforms is an important area of research in the context of nonprofit organizations and e-government.

Platform Governance

To establish successful platform ecosystems, not only is the platform's architecture decisive, but also the governance of the ecosystem that surrounds the platform (Tiwana, Konsynski, & Bush, 2010). According to Tiwana (2014), platform governance can be defined as the "partitioning of decision-making authority between platform owners and app developers, control mechanisms, and pricing and pie-sharing structures". While Tiwana's dimensions of platform governance are tailored to software application platforms, other authors identify aspects of platform governance by analyzing diverse types of digital platforms. To structure the aspects of platform governance discussed in literature, we derive a set of governance mechanisms that include the dimensions suggested by Tiwana and mechanisms from other studies including mechanisms we identified in an earlier literature study (Hein, Schreieck, Wiesche, & Krcmar, 2016; Schreieck, Wiesche, & Krcmar, 2016).

The first mechanism relates to the overall governance structure, which can be decentralized or centralized (Nambisan, 2013). This refers to the partitioning of decision rights and the ownership status of the platform (Tiwana, 2014). The second mechanism refers to accessibility and control of platform ecosystems. A platform ecosystem needs to be open to a certain degree (Eisenmann, Parker, & Van Alstyne, 2009) but openness needs to be accompanied by control mechanisms to avoid uncoordinated effort hindering co-creation of value (Ghazawneh & Henfridsson, 2013; Tiwana, 2014). Control mechanisms include formal control as in input and output control and informal control as in self and clan control (Goldbach & Benlian, 2015a). Trust forms the third mechanism, which relates to the measures of a platform ecosystem to enhance trust and reduce perceived risk (Hurni & Huber, 2014; Nambisan, 2013) on the complementor or user side. As the continuous interaction of complementors and users is vital to platform ecosystems, trustful relationships must be built. The fourth mechanism summarizes boundary resources, which represent all kinds of resources a platform provides for complementors (Eaton, 2015; Ghazawneh & Henfridsson, 2013). These may cover documentation on the platform, tools, or APIs. In most platform ecosystems the mechanism of pricing is relevant as an additional mechanism (Caillaud & Jullien, 2003; Tiwana, 2014). As the refugee information platform is a voluntary project void of financial transactions on the platform, we will not include this mechanism in our study.

Community Governance and IT-Enabled Collaboration

An information platform for refugees is dependent on a platform ecosystem with heterogeneous information providers that collaborate in communities. While application developers of software platforms can develop complementary applications individually, information providers need to create the information together as part of a temporary information network (Pan, Pan, & Leidner, 2012). A community is necessary to compile the information for each municipality providing information on the platform. Local communities need to cooperate with other communities to avoid redundant work, which may prove difficult due to the autonomy of different municipalities. Overcoming challenges of this kind has been identified as one of the key objectives of collaboration between governmental agencies in developing countries (Ezz, Papazafeiropoulou, & Serrano, 2009).

The setup of our study is similar to other community projects such as knowledge communities (e.g., Wikipedia) or open source communities (e.g., Linux). IS researchers have in particular worked on open source communities to derive governance mechanisms and strategies for IT-enabled collaboration in online communities (O'Mahony & Ferrarro, 2007; Shah, 2006; Teixeira & Lin) as well as on the importance of those communities in developing countries (Ahmed, 2007; Hatakka, 2009).

The governance of online communities faces issues similar to those faced by the governance of platform ecosystems. One example might be trust, which is not only an important governance mechanism in platform ecosystems but also crucial for collaboration in online communities (Cheng, Nolan, & Macaulay, 2013) and distributed teams (Cheng, Fu, & Druckenmiller, 2016; Cheng, Yin, Azadegan, & Kolfschoten, 2016). Furthermore, in both communities and platform ecosystems, third parties contribute to a joint project and need to be incentivized and managed throughout the period of participation. According to Sagers (2004): "a project must deal with the complexity of coordinating the efforts of a geographically distributed base of volunteers to create a working software product." Mechanisms to govern communities are discussed by Markus (2007) and De Laat (2007). According to Markus (2007), community governance includes six categories of formal and informal structures and rules: ownership of assets, chartering of the project, community management, software development process, conflict resolution, and use of information and tools. The mechanisms proposed by De Laat (2007) cover modularization, division of roles, delegation of decision-making, training and indoctrination, formalization, and the tradeoff between autocracy and democracy.

These mechanisms are related to the mechanisms of platform governance discussed above. We integrate the mechanisms of community governance and the mechanisms of platform governance in a summary table (Table 1).

-- Insert Table 1 about here --

The summary of governance mechanisms across platform governance and community governance identifies which aspects of governance are relevant for a project such as an information platform for refugees. However, it remains unclear how these mechanisms can be implemented in the context of nonprofit platform ecosystems. Existing recommendations, as for example those proposed by Tiwana (2014) or Gawer and Cusumano (2013), are based on commercial platform ecosystems such as application platforms and industry platforms.

Nonprofit platform ecosystems differ from commercial platforms in several ways. While in commercial platforms the platform owner can compensate complementors for centralized governance via pricing mechanisms, this mechanism is not available in nonprofit platform ecosystems. Owners of nonprofit platforms are also unable to implement or coerce control. As a result, the platform owner may need other measures to maximize value creation within the platform ecosystem. The mechanism of trust might gain importance in nonprofit platform ecosystems as complementors invest their effort voluntarily without expectations of direct benefit. While trust is also relevant for complementors in commercial platforms (Hurni & Huber, 2014), it is a decisive factor for nonprofit organizations in general (Bekkers, 2003). Because nonprofit platforms depend on contributions from third parties to carry out their daily work, trust is not only important for their reputation but is also a prerequisite for third parties with potential interest in contributing to the platform.

In summary, existing research helps to identify governance mechanisms relevant for nonprofit platform ecosystems. Yet, our current knowledge is not sufficient to understand how governance mechanisms can be applied in order to successfully bring together and manage the IT-enabled collaboration of various actors on a nonprofit platform. In particular, incentivizing the actors to contribute to the platform while at the same time controlling them is an open issue for nonprofit platforms. We address this gap with an action research study focusing on governing information providers within an information platform ecosystem.

Method

We conducted an action research study to develop a strategy for the governance of an information platform ecosystem for refugees. Action research has been defined as “a post-positivist social scientific research method, ideally suited to the study of technology in its human context" (Baskerville & Wood-Harper, 1996). We chose this methodology for two reasons. First, action research is applicable to evaluate a complex and rare phenomenon not suitable for empirical analysis (Mathiassen, 2002). The ecosystem of an information platform is complex due to a large number of heterogeneous information providers. As a result, the development of a suitable governance strategy is also a complex and challenging process. Governance strategies for these types of information platforms are rare: the first digital information solutions for refugees emerged in 2015 and only a few of them have been established successfully. Second, action research is adequate if it is necessary to not only gain insights on a phenomenon but also to directly apply the knowledge in practice to advance the project (Mathiassen, 2002). Due to the criticality of the situation of refugees arriving in Europe, it made sense to directly apply the developed governance strategy in order to help refugees as soon as possible.

Action research studies are a special form of case studies. In contrast to traditional case studies where researchers observe the object of the study, in action research studies the researchers actively participate in the project to both take and evaluate actions (Yin, 2009). This participatory design was possible as the authors were part of the project team. As part of the project team, we implemented platform governance mechanisms to stimulate third-party contribution to the platform. The effect of these interventions was evaluated based on usage data and additional insights from workshops and interviews with information providers.

We followed the cyclical process of action research along five steps (Susman, Evered, Susman, & Evered, 2012; Ziegler, 2001): (1) *Diagnosing* to identify or define the problem at hand; (2) *Action Planning* to consider alternative actions that can be taken to solve the problem at hand; (3) *Action Taking* to select suitable actions and implement those actions; (4) *Evaluating* to assess the consequences of the actions taken; (5) *Specifying Learning* to gain general insights from the approach taken to tackle the project at hand. We ran through this process twice to develop a governance strategy for the information platform for refugees. To ensure rigor and relevance of our action research study, we evaluated the study against the five evaluation principles for action research studies as laid out by Davison, Martinsons, and Kock (2004). As summarized in Table A.1 of the Appendix, our study fulfills the *Principle of the Researcher–Client Agreement*, the *Principle of the Cyclical Process Model*, the *Principle of Theory*, the *Principle of Change through Action*, and the *Principle of Learning through Reflection* (Davison et al., 2004).

The Case of *INTEGREAT*[2]

Before evaluating governance strategies, this section pictures the case that frames the action research study. We first provide an overview of the project *INTEGREAT* and then describe the main governance challenges faced by the project.

Project Description

The point of departure of the project *INTEGREAT* was the arrival of a large number of refugees in Europe in summer 2015 who then encountered a lack of information about their new environment (see also Qayyum et al., 2015). This information deficit is a direct result of the complex information ecosystem faced by refugees. As illustrated in Figure 1, refugees are dependent on information related to various topics that can be roughly clustered as follows: information on first steps related to registration and government requirements, points of contact, language, health care, education and work, family and daily life. A large number of different information sources addressing these information needs are available. In addition to the high

[2] www.integreat-app.de.

heterogeneity in the information sources, the information is dynamic and in some cases quickly outdated. Local points of contact may change, new offers may be introduced, and adjustments made to the asylum process. Refugees are often relocated after arrival at an initial reception facility making parts of the information inaccurate for later use (Schreieck, Zitzelsberger, Siepe, Wiesche, & Krcmar, 2017).

-- Insert Figure 1 about here –

The project *INTEGREAT* strives to address the information deficits of refugees. *INTEGREAT* is a mobile application that provides relevant information for refugees via a smartphone application. The app comprises general information as well as specific information of relevance in the respective municipality. Users choose the municipality according to their location when they open the app. The information provided in the app is also available offline. Refugees usually have only sporadic access to the internet as they use local Wi-Fi hotspots and generally do not have mobile service. The app is available in different languages: In addition to English, French and German, the languages of the major countries of origin are included, in particular Arabic and Farsi. The mobile app was developed in Android as our experience during the project was that the majority of refugees uses smartphones with this operating system. Exemplary screenshots of the INTEGREAT mobile app are shown in Figure 2.

-- Insert Figure 2 about here --

The counterpart of the mobile app is the backend, which is used to input the information displayed in the app. The backend comprises a content management system (CMS) based on WordPress. WordPress is a free open source software to build blogs, websites and CMS (WordPress, 2016) and was chosen as it is the most successful available free tool for websites and is therefore very likely to be further developed and maintained in the future. The basic configuration of WordPress was enhanced by available plugins to support, for example, multi-language sites. Some plugins were developed by the project team to address specific needs of the users such as a multi-language PDF export of information in case refugees do not have a smartphone.

A municipality wanting to use the system is granted access to a dedicated instance of the CMS backend realized via a multi-site setup of the WordPress-powered CMS. The instance is prefilled with general information common for all municipalities including information on the asylum evaluation process. Users from the municipality can then decide to edit the available general information and start to add information specific to their municipality. As the information for one municipality is distributed among a large number of information providers, an arbitrary number of users can be granted access to the system. The user management comes with a fine-grained rights management. For example, a local initiative that organizes regular events for refugees can be granted access only to the Events section of the CMS. In this way, a local community of information providers emerges. In summary, the project *INTEGREAT* provides a stable core architecture that forms the basis of the information platform as pictured in Figure 3.

-- Insert Figure 3 about here ---

The setup of the project as a platform allows different information providers and stakeholders to interact with the project team and the system. These groups need to be considered when developing a governance strategy. Besides the core team and developers, municipalities, NGOs, local initiatives, and volunteers are the main information providers (Figure 1). The municipalities run several offices such as the social assistance office or the youth welfare office who possess valuable information. NGOs and local initiatives have gained domain-specific knowledge through their continual work with refugees and volunteers and are able to add specific information such as event information. Sometimes the information providers pursue different goals and are driven by a different political agenda making the governance of the ecosystem more challenging.

Governance Challenges

Managing the ecosystem of information providers and stakeholders emerged as the main challenge for the project *INTEGREAT*. Although some technical challenges arose in the course of the project, for example, related to the interplay of plugins in WordPress, these challenges never represented a serious risk for the project. Instead, the main issues were related to the acquisition of information providers, the identification of relevant contact persons in the municipalities, and the handling of information overflow often produced by the providers of information. As the platform ecosystem grew, further issues arose. The motivation of information providers had to be ensured and a decentralized method to organize information providers that at the same time ensured content quality had to be established.

The description of the main challenges makes clear the necessity of a governance strategy to manage the heterogeneous community of information providers. The governance mechanisms derived from literature, i.e. governance structure, accessibility and control, boundary resources, and trust can help to address these challenges. However, literature does not provide insights on how to apply these mechanisms in the context of *INTEGREAT*. Accordingly, the project team was unsure how centralized the governance should be structured in order to keep the project manageable while incentivizing decentral information providers. The team had to decide whether to apply formal control mechanisms to ensure content quality or whether to rely on informal mechanisms. In addition, we were unsure how to build trust between the different parties and which boundary resources should be provided for information providers. Therefore, it was crucial for the project's success to evaluate how the governance mechanisms as part of a sustainable governance strategy should be best implemented.

Governance Strategy

A governance strategy is the result of the planned implementation of governance mechanisms in a specific configuration (see also Schwarz & Hirschheim, 2003). We derived the following governance mechanisms from platform and community governance literature: governance structure, accessibility and control, trust, and boundary resources. Within an action research study with two cycles, we define, evaluate, and refine the implementation of these mechanisms as part of a governance strategy. The effectiveness of the strategy was measured using the number of new municipalities that implemented *INTEGREAT* and the activity level[3] on the content management system of the platform. We enhanced the quantitative analysis with qualitative insights from workshops, interviews, and surveys conducted with information providers and refugees as summarized in Table 2. Throughout the Results section, we will refer to these insights. We analyze the two action research cycles following the phases of an action research study as described by Susman et al. (2012): Diagnosing, Action Planning, Action Taking, Evaluating, and Specifying Learning.

-- Insert Table 2 about here --

First Action Research Cycle

The first action research cycle to develop a governance strategy of the *INTEGREAT* platform started when the basic functionalities were implemented for the first municipality in October 2015. The positive feedback the project received in the media and from other municipalities made it clear that *INTEGREAT* could be beneficial for all municipalities hosting a substantial number of refugees. Therefore, the research team together with the project team decided to roll out the information platform, requiring a governance strategy to incentivize and manage information providers.

Diagnosing and Action Planning. In the first two months after the start of *INTEGREAT* in the

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[3] Activity was measured as the number of 'save' and 'edit' operations performed in the CMS.

first community, more than 20 municipalities and associated information providers were interested in the platform and requested information on how it could be introduced in their municipality. It was not sufficient to just grant the municipality access to their own instance of the CMS. New municipalities needed to be supported to onboard successfully and in a sustainable way. Literature shows that the initial phase of a platform ecosystem is decisive for its success (e.g., Evans & Schmalensee, 2010). Therefore, the project team together with the researchers developed actions suited to govern the heterogeneous information providers.

Action Taking. Actions were taken across all governance mechanisms to support the integration of new municipalities in the ecosystem (Table 3). The governance structure had to be decentralized in order to incentivize volunteers and to cope with the decentralized information structure. Therefore, new municipalities were given direct access to the system and the possibility to enter and structure information in their preferred way. Similarly, restrictions were minimized for the mechanism accessibility and control. Barriers for new members were reduced by making the CMS as intuitive as possible and no dedicated control process was introduced to prevent the demotivation of information providers. To strengthen trust in the project and its sustainability, the project collaborated with an established initiative that has been engaged in work with refugees for more than two decades and with a renowned university. Boundary resources were distributed by the team members on an individual basis through, for example, individual counseling of information providers wanting to use the platform.

-- Insert Table 3 about here --

Evaluating and Specifying Learning. The evaluation of the number of new municipalities that implemented the information platform showed that the governance strategy was efficient regarding the onboarding of complementors on the platform. In the first month, six municipalities requested to roll out the system in their area and initiated the collection of information followed by a roll out by nine municipalities in the second month (Figure 4). Based on feedback from the contact persons, we identified the governance actions that had the largest impact on the onboarding decision. It was important that the CMS was intuitive to use as information providers from municipalities, NGOs, and local initiatives were not as IT-savvy as initially expected (I_1, Table 2).

Collaboration with an established initiative in the area of asylum counseling had proven helpful in enhancing the complementors' trust in the platform ecosystem (W_1, Table 2). However, the analysis of activity data on the CMS showed that after the first two months, the activity level of information providers declined (Figure 5). Some municipalities lost interest shortly after onboarding and others gathered most of the relevant information but did not manage to finalize it. Furthermore, a quality check of the information on the platform revealed an overflow of unstructured information in some topics, while others were not covered (S_1, Table 2). As this unstructured information was, for some municipalities, visible in the app, this posed a threat to the project's reputation.

Given the learning of the first action research cycle, the onboarding-focused governance strategy was in part successful in the early phase of the project but needed refinement to improve the sustainability of the involvement of the information providers.

Second Action Research Cycle

The governance strategy in the first action research cycle had resulted in onboarding of a significant number of municipalities. Local media coverage, dedicated articles in journals for mayors of municipalities and other members of bodies of the government as well as information distributed via social media sparked interest in the project. However, onboarding had not been sustainable for all municipalities. Therefore, the governance strategy was adapted with a stronger focus on sustainability. The goal was to enable continued onboarding while at the same time ensuring that the municipalities would not lose interest.

Diagnosing and Action Planning. Although the pilot municipality successfully introduced the platform, not all of the municipalities that started using the platform finished the introduction process of the *INTEGREAT* app. Those who finished the implementation had included a lot of unstructured information potentially leading to an information overflow for the user. The main challenge of the second action research cycle was therefore to identify governance actions that increase the information providers' motivation and at the same time improve the quality of the provided content. The underlying tradeoff between the openness of platform ecosystems and control of complementors is a known issue in research on commercial platform ecosystems (e.g., Benlian et al., 2015; Boudreau, 2010).

Action Taking. Actions were taken across all governance mechanisms to refine the governance strategy (Table 4). For the governance structure, elements of a more centralized governance were introduced in order to improve the quality of content on the information platform. It was decided to introduce a standardized structure for the content that had to be implemented by municipalities. The so-called 6+2 concept comprises six predefined chapters of information and two chapters to be defined by the individual municipality. This structure should not only make the information more easily searchable, but also increase the "brand recognition" of the *INTEGREAT* app. To balance the more centralized governance structure, the possibility to market the app as a stand-alone information app by a certain municipality was introduced. While the app would adhere to the "corporate identity" of *INTEGREAT*, the commitment of the municipality would become more visible increasing the motivation of the people involved. A more structured onboarding process and a pragmatic input control were introduced for the governance mechanism accessibility and control. A structured onboarding process helped municipalities to better understand the scope of the project and estimate the resources they needed to invest in the project. The input control was assigned to one responsible person per municipality. In this way, input control was decentralized yet formalized. While decentralized control might be less effective than centralized control, it addressed the problem of missing perceived legitimation of the platform owner to implement control. Trust had emerged as an important factor in the first research cycle. Consequently, the founding of a nonprofit association[4] was emphasized; it was thought that the establishment of a legal entity behind the project would serve to strengthen the information providers' trust in the project. Furthermore, open sourcing of the *INTEGREAT* project's source code along with the content of the platform contributed to the project's credibility. Intangible boundary resources were implemented in the second research cycle to support municipalities in compiling relevant information on the platform in a structured way. First, a dedicated community manager who consults the responsible contact person on how to manage the local community of information providers was introduced. Second, to improve the exchange of information and best practices among municipalities, conferences were organized and a common communication tool was introduced. Both measures are known to improve the meta-knowledge of the involved information providers, i.e. the knowledge of 'who knows what' and 'who knows whom' (Leonardi, 2014). As tangible boundary resource, translation support was provided by making automated translation accessible in the CMS and by cooperating with a professional translation agency.

-- Insert Table 4 about here --

Evaluating and Specifying Learning. After the implementation of the new "sustainable" governance strategy, the activity on the platform increased significantly while at the same time new municipalities continued to onboard (see Figure 4 and Figure 5). The values for activity in December 2015 and January 2016 were affected by the Christmas holidays but February and March 2016 showed a substantial increase in activity. The information provided on the platform

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[4] Tür an Tür Digital Factory gGmbH, http://tuerantuer.de/digitalfabrik/.

became more complete and structured for the new municipalities compared to the first action research cycle. Municipalities reported that the hierarchical 6+2 concept in the CMS helped them to structure the information better (S_2, Table 2). The founding of an NGO convinced municipalities and information providers that the *INTEGREAT* project would be sustainable and therefore they were motivated to contribute on a long-term basis (e.g., W_3, Table 2). Information providers welcomed the boundary resource of automated translation (S_2, Table 2).

In sum, the "sustainable onboarding" governance strategy was a successful enhancement of the "onboarding" governance strategy applied in the first action research cycle. Based on discussions with contact persons in the municipalities, the balance of more guidance and stronger trust in the societal impact of the project were key to an effective governance strategy.
-- Insert Figure 4 and Figure 5 about here --

Discussion

In this section, we discuss how our findings inform the application of governance in nonprofit platform ecosystems as compared to commercial platform ecosystems. We then discuss the contributions our work makes to theory and practice in the area of governance.

Governance in Nonprofit vs. Commercial Contexts

The governance strategy we developed in our study differs from strategies known from commercial platforms along the mechanisms governance structure, accessibility and control, trust, and boundary resources. The implementation of each governance mechanism is affected by the fact that the platform is non-commercial and serves a social cause (Table 5).

-- Insert Table 5 about here --

As decentralized governance had led to an unstructured accumulation of information on the platform, we adopted a more centralized governance strategy. This may in turn have negatively affected the complementors' motivation as they lose decision rights. In commercial platform ecosystems, the platform owner can compensate complementors for centralized governance by providing resources and sharing revenues. In some cases, centralization can be enforced due to the dominant market position of the platform owner (see Eaton, 2012 for the case of Apple). By contrast, in nonprofit platform ecosystems, revenue sharing is not available as a compensation for complementors and a dominant market position of an NGO does not necessarily help to enforce governance mechanisms. Instead, centralizing governance in nonprofit platform ecosystems can be built on establishing a relationship which fosters co-creation and openness (Loudon & Rivett, 2014). In the *INTEGREAT* project, participating municipalities were supported in hosting a press event and had the opportunity to be an associated partner of the project.

By implementing the governance mechanisms accessibility and control, we found that in an information platform for refugees, input control is necessary to ensure the quality of information. In commercial platform ecosystems, formal and informal control mechanisms are applied by the platform owner in a centralized manner to ensure quality. The platform owner is legitimized by ownership and by his market power. In nonprofit platform ecosystems, applying control can negatively influence the complementors' motivation: from their point of view, the platform owner has no legitimation to apply control. Contributors to nonprofit projects often have a specific idea of how they want to contribute and may be unwilling to adhere to control processes. Therefore, informal control mechanisms such as self and clan control may be more effective than formal control mechanisms. Clan control can be strengthened by establishing a community with shared norms and values (Goldbach & Benlian, 2015b). In the project *INTEGREAT*, control processes were assigned to experienced information providers within the local communities of information providers. Due to their expertise, they were perceived by the other information providers as legitimated to apply control.

The mechanism trust may have greater importance in nonprofit platform ecosystems than in commercial platform ecosystems. In commercial platforms, the interplay of trust and power affects the relationship between platform owner and complementors (Hurni & Huber, 2014). The complementor has to trust in the reliability of the platform and in the platform owner's intention to continue the platform (Goldbach & Benlian, 2015a). In nonprofit platform ecosystems, this trust in the platform is enhanced by trust in the community of complementors (Cheng et al., 2013) and their shared norms and values (Tiwana, 2014). Therefore, establishing trust between platform owner and complementors as well as among complementors is vital to nonprofit platform ecosystems. Only when complementors have trust in the platform and the community, their initial motivation will translate into engagement on the platform.

Finally, boundary resources have to be implemented differently in nonprofit than in commercial platform ecosystems. In commercial platform ecosystems, standardized boundary resources such as documentation, tutorials, APIs and SDKs facilitate the onboarding of a large number of complementors. While documentation and easy-to-use interfaces are also helpful in community-driven nonprofit platform ecosystems, the implementation of boundary resources needs to support the community building. Labeled as "indoctrination" by De Laat (2007), measures such as nominating local community managers or holding conferences to connect information providers are boundary resources that enhance the community. Tools that make communication visible (e.g., Slack) further strengthen value creation by the community by increasing meta knowledge of community members (Leonardi, 2014). Boundary resources need to be better adapted to the individual complementor and his community.

In summary, governance strategies for nonprofit platform ecosystems differ from those for commercial platform ecosystems in IS. While the same governance mechanisms are applied, they cannot be implemented as effectively in nonprofit as in commercial platform ecosystems due to a perceived weaker position of the platform owner. By making concessions to the complementors in the implementation of a governance strategy, the platform owner can still use platform governance to maximize value co-creation and, as a result, the societal effect of the platform ecosystem.

Contribution to Theory

With our study we contribute to three streams of research: (1) platform governance, (2) IT-enabled collaboration, and (3) IT for development with a focus on refugees.

Scant literature exists on platform governance to manage co-creation of value in nonprofit contexts. The goal of the platform owner is not to capture as much value as possible, but rather to maximize societal impact via co-creation of value. This affects the implementation of platform governance. In our study we show that the governance of nonprofit platform ecosystems is based on the same underlying mechanisms as for commercial platforms but the implementation of the mechanisms differs. Whereas in for-profit platform ecosystems, platform governance aims at maximizing value co-creation along with value capture of the platform owner, in non-profit platform ecosystems, platform governance helps to stimulate value co-creation in a way that the co-created value is beneficial for society. Furthermore, as nonprofit platform ecosystems are to a greater degree community-driven, the implementation of platform governance is informed by community governance. The integration of community governance concepts is new to platform governance research as platform governance mainly focuses on the perspective of the platform owner. Finally, our study contributes to the literature stream on how information and communication technologies can support nonprofit projects (e.g., Selander & Jarvenpaa, 2016) and in particular the integration of refugees (Andrade & Doolin, 2016).

By developing governance strategies for communities of information providers that work together via a digital platform we also contribute to literature on IT-enabled collaboration.

Online communities are one way IT enables collaboration among diverse parties as evidenced by knowledge communities (e.g., Wikipedia) or open source communities (e.g., Linux). There are both online communities with a dedicated commercial purpose, such as idea platforms created by companies (Blohm, Bretschneider, Leimeister, & Krcmar, 2011), and nonprofit online communities, such as Wikipedia and most open source projects (Teixeira & Lin). While companies that run commercial communities can grant monetary incentives to govern collaboration within the community, governance in nonprofit communities is more difficult. Although O'Mahony and Ferrarro (2007) and Shah (2006) analyze this situation for open source projects, we are able to add to their findings for the context of a nonprofit information platform. In particular, we show that the design of the IT artefact that enables collaboration is an important factor influencing collaboration. In the case of *INTEGREAT*, the design and usability of the CMS laid the basis for the implementation of community governance mechanisms. Building on the IT artefact, governance mechanisms such as fostering trust can be applied and spark collaboration on the platform (Cheng, Yin, et al., 2016).

Developing and governing a digital platform that supports both information gathering and information seeking is a first step toward understanding the role of information systems in a globalized world challenged with poverty, persecution, and migration swapping in the global North (Heeks, 2008; Qureshi, 2015). Understanding governance mechanisms for nonprofit platforms is a necessary first step to support collaboration between countries, municipalities, volunteers, and refugees to address the information needs of refugees (Andrade & Doolin, 2016). These findings may also inform in a more general way the coordination of social movement organizations in both developing and developed countries (Selander & Jarvenpaa, 2016).

Contribution to Practice and Society

First, our study directly contributed to the societal impact of the information platform ecosystem for refugees *INTEGREAT*. By developing a suitable governance strategy, not only did the ecosystem of information providers grow, but also the number of apps installed reached more than 3,300. Thereby, the information gathered on the platform reached the target group and helped to overcome the information deficit of refugees arriving in Europe. Overall it can be shown that important information needs for refugees (Caidi et al., 2010) can be satisfied with the nonprofit platform solution. Especially the boundaries of cross-cultural communication, a major limiting factor for information sharing (Bajwa, Lewis, Pervan, & Lai, 2014; Caidi et al., 2010), can be addressed by offering multi language support customized to the individual needs of refugees residing in different municipalities. The information platform will not be able to replace face-to-face asylum counseling but it can make counseling more efficient as basic information is already provided on the platform. For example, the possibility to update information directly in the system reduces the effort required to inform individual refugees about relevant changes. The knowledge on platform governance gained from this study will inform the way new features will be developed and maintained by the community. For example, an offline map and a navigation feature is being developed but it will only be useful if the community provides up-to-date point of interests for the users (see also Pflügler, Schreieck, Hernandez, Wiesche, & Krcmar, 2016).

Second, the contribution of our study is applicable to other platform ecosystems that enable co-creation of value in a nonprofit context. In e-government the potential of co-creation of value is underrated (Adeleke & AbdulRahman, 2011; Kuk & Janssen, 2013). Citizen involvement platforms are one example of co-creation of value in e-government that may benefit from insights on the application of governance. Our study provides an overview of the governance mechanisms that need to be considered by platform owners and suggests an adequate implementation of these mechanisms as part of a governance strategy.

Lastly, the concepts we developed on governing nonprofit platforms can be applied to support developing countries by establishing collaboration and knowledge sharing. However, when developing and implementing nonprofit platforms in developing countries, factors such as the technological development of the country, age, education and income of the targeted users, and possibly geographic location (e.g., whether it is more rural or urban territory) need to be taken into consideration (Loudon, 2016).

Conclusion

In this study we derive a governance strategy for a nonprofit platform ecosystem. By conducting an action research study within the project *INTEGREAT*, an information platform for refugees, we combine governance mechanisms to a suitable governance strategy. Our results push the project *INTEGREAT* forward and thus help to overcome the information deficit that refugees face when they arrive in a host country.

The study thereby contributes to co-creation of value theory in the context of nonprofit platform ecosystems. While the same basic governance mechanisms are relevant to foster co-creation of value, nonprofit platforms cannot rely heavily on a centralized governance structure, strict control, and standardized boundary resources. Instead, the governance structure needs to be carefully balanced and trust is a key component of the governance strategy. Our findings furthermore enhance literature on IT-enabled collaboration in nonprofit communities as we show how decentralized local communities of information providers can efficiently collaborate via a digital content management system.

Our study entails several limitations. First, the scope of our action research study is limited. We analyze one case only as the phenomenon at hand, i.e. information platform ecosystems for refugees. Although the project includes a productive information community used by several communities, it is a relatively small platform ecosystem compared to commercial platform ecosystems. By conducting two cycles of an action research study, we obtained in-depth insights into the platform which we compare to current literature on platform governance and IT-enabled collaboration. We therefore believe that the findings of our study are generalizable for nonprofit platforms. Nevertheless, follow-up studies with multiple cases and international NGOs could validate our results, perhaps by applying quantitative methods. Second, as a corollary of conducting an action research study, the active participation of researchers in the project impedes their objectivity. We have addressed this limitation by using adopting triangulation techniques such as interviews, workshops, and surveys to increase the objectivity of our results. Still, traditional case studies could help to minimize methodological bias.

Previous research has showed that collaboration systems also work for developing countries like Tanzania and South Africa (De Vreede, Mgaya, & Qureshi, 2003), so the next step could be testing social platforms in those regions. Another interesting aspect could be the implementation of collaboration aspects like voting features in order to increase the effectiveness and efficiency of the overall platform (Cheng & Yu, 2015). Finally, to better understand the impact of IT for refugees, it could be interesting to analyze the benefit of information platforms. In this context, it would be worthwhile to consider the digital divide (Ahmed, 2007; Norris, 2001) and what measures could be applied to overcome the digital divide for refugees. For example, a series of qualitative interviews with refugees and asylum counselors in municipalities could contribute to deepening our understanding of the value of IT for the social inclusion of refugees.

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Appendix

Table A.1. Evaluation of the five principles of action research studies by Davison et al. (2004).

Principle	Description	Evaluation
Principle of the Researcher–Client Agreement	This principle ensures that researchers and clients (i.e. the practitioners) agree on conducting an action research study and on a common goal.	Researcher and practitioners agreed that a cyclical action research approach was suitable due to the criticality of the situation. The project goal and project responsibility were specified explicitly.
Principle of the Cyclical Process Model	This principle fosters an action research study's rigor by ensuring that all five phases of an action research process are conducted systematically.	As described in the results section, our study comprised two action research cycles following Susman et al. (2012).
Principle of Theory	An action research study has to be linked to existing theory in order to be of scientific relevance.	Our study builds on and contributes to literature on co-creation of value through platform ecosystems as well as to literature on IT-enabled collaboration.
Principle of Change through Action	This principle ensures that actions are taken within the scope of the action research study that contribute to solving the diagnosed problem.	In our study, we implemented governance mechanisms to derive a suitable governance strategy for an information platform ecosystem. The effects of these actions were documented and evaluated based on performance indicators of the platform as well as insights from interviews, workshops, and surveys with information providers.
Principle of Learning through Reflection	To ensure an action research study's relevance, this principle highlights that insights gained from the specific case need to be generalized in order to be applicable in other contexts as part of a reflection process.	In our study, researchers and clients together discussed the learnings based on the evaluated results. By linking these insights to the theory of co-creation of value in platform ecosystems in the discussion section, we generalize the findings of our study.

Tables and Figures from Body

Table 1. Mechanisms of platform and community governance.

Mechanisms	Platform governance	Community governance
Governance structure	• Centralized vs. decentralized • Distribution of decision rights • Ownership status	• Autocracy/democracy • Chartering rules • Ownership of assets • Division of roles, delegation of decision-making
Accessibility & control	• Openness • Control mechanisms	• Software development process • Formalization • Modularization
Trust	• Trust building • Minimization of perceived risk	• Conflict resolution
Boundary resources	• Resources and documentation • Transparency	• Training and indoctrination • Use of information and tools • Community management

Table 2. Sources of qualitative insights.

ID	Type	Participants	Date
W_1	Workshop	• Three employees of the social office of a German municipality considering introducing *INTEGREAT* • Three members of the *INTEGREAT* project team	October 21, 2015
I_1	Interview	• Chairperson of a nonprofit association. She led the introduction of *INTEGREAT* in a German municipality. • One member of the *INTEGREAT* project team	January 11, 2016
S_1	Survey	• Survey among 15 refugees in Germany who tested the *INTEGREAT* mobile app	February 2016
W_2	Workshop	• Regional coordinator for refugee initiatives • Member of nonprofit organization that supports disadvantaged people throughout Germany • Two members of the *INTEGREAT* project team	February 12, 2016
W_3	Workshop	• Several members of the government of a German municipality • Several refugees hosted by the municipality • Two members of the *INTEGREAT* project team	September 22, 2016
S_2	Survey	• Feedback survey among information providers with 39 participants	December 2016

Table 3. Governance strategy “Onboarding” in the first action research cycle.

Mechanisms	Description	Actions taken
Governance structure	Decentralized governance in order to incentivize volunteers and to handle decentralized information structure.	• Direct access for content providers to the content management system (CMS) • Decisions on information and information structure made by information providers
Accessibility & control	Open platform with free access for information providers.	• Intuitive CMS • No dedicated quality control of information
Trust	Build trust in sustainability of the project.	• Partnering with established initiative • Official support of the project by universities
Boundary resources	Resources distributed by team members on an individual basis.	• Individual counseling for information providers

Table 4. Governance strategy “Sustainable Onboarding” in the second action research cycle.

Mechanisms	Description	Actions taken
Governance structure	Elements of a more centralized governance.	• “Corporate identity” but possibility of local stand-alone app • 6+2 structure of content with general content prefilled
Accessibility & control	Introduction of pragmatic input control.	• Structured onboarding process for content providers • Quality check for information
Trust	Strengthen trust in sustainability of the project.	• Foundation of a nonprofit association • Open sourcing of code and content
Boundary resources	Focus of intangible but effective boundary resources.	• Dedicated community manager • Conferences for content providers • Slack as tool for communication in a decentralized project setting • Translation support

Table 5. Platform governance in commercial and nonprofit platform ecosystems.

Mechanisms	Commercial platform ecosystems	Nonprofit platform ecosystems
Governance structure	• Balance centralization against shared pricing	• Balance centralization against chartering and representation
Accessibility & control	• Centralized, formal control • Legitimation by ownership and market power	• Decentralized, informal control (i.e. clan control) • Legitimation by expertise
Trust	• Trust in platform technology and owner • Focus on reliability and continuance	• Trust in platform technology and owner • Trust in complementor community • Focus on shared norms and values
Boundary resources	• Standardized boundary resources • Focus on documentation and tools	• Individual boundary resources • Focus on community management

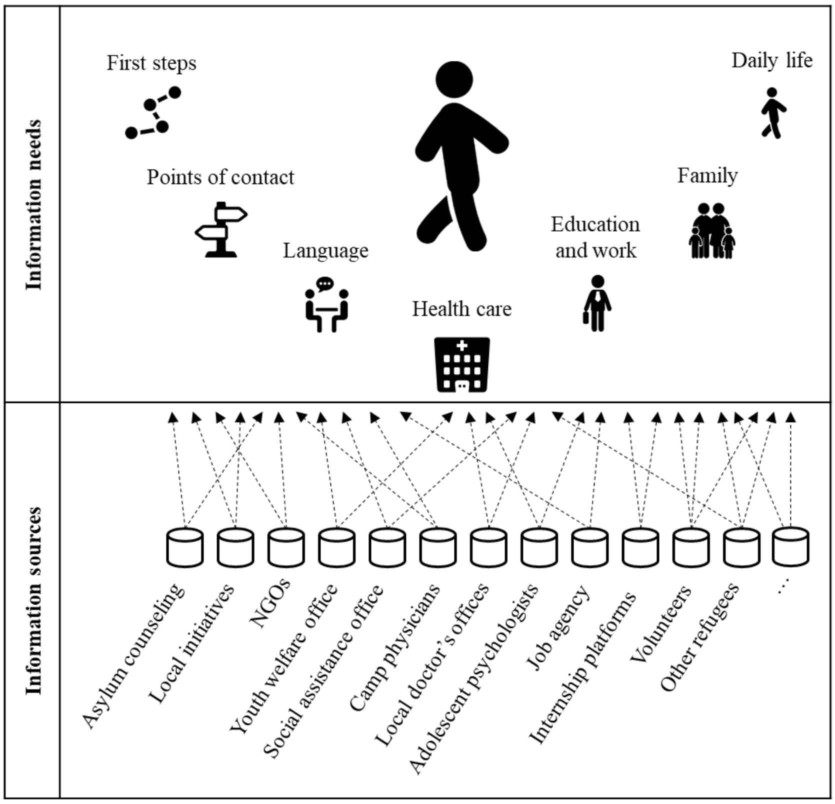

Figure 1. Heterogeneous information ecosystem for refugees.

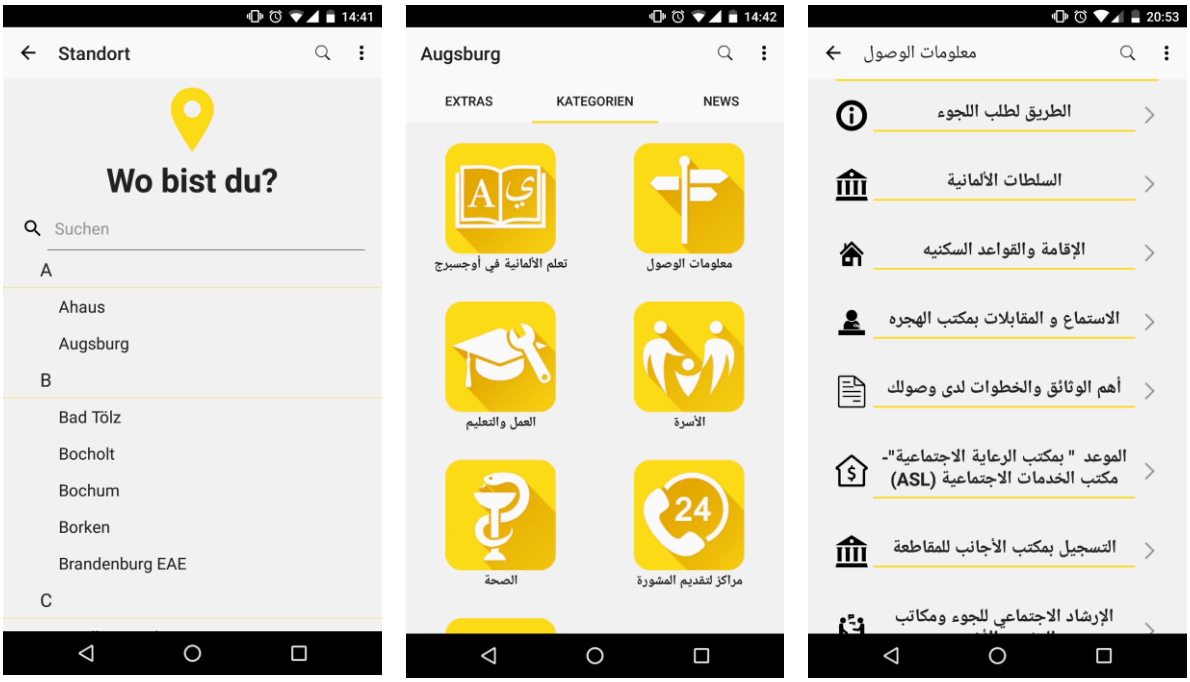

Figure 2: Exemplary screenshots of the INTEGREAT mobile app (from left to right: location selection, main categories, and subcategories; source: Tür an Tür Digital Factory gGmbH, 2017)

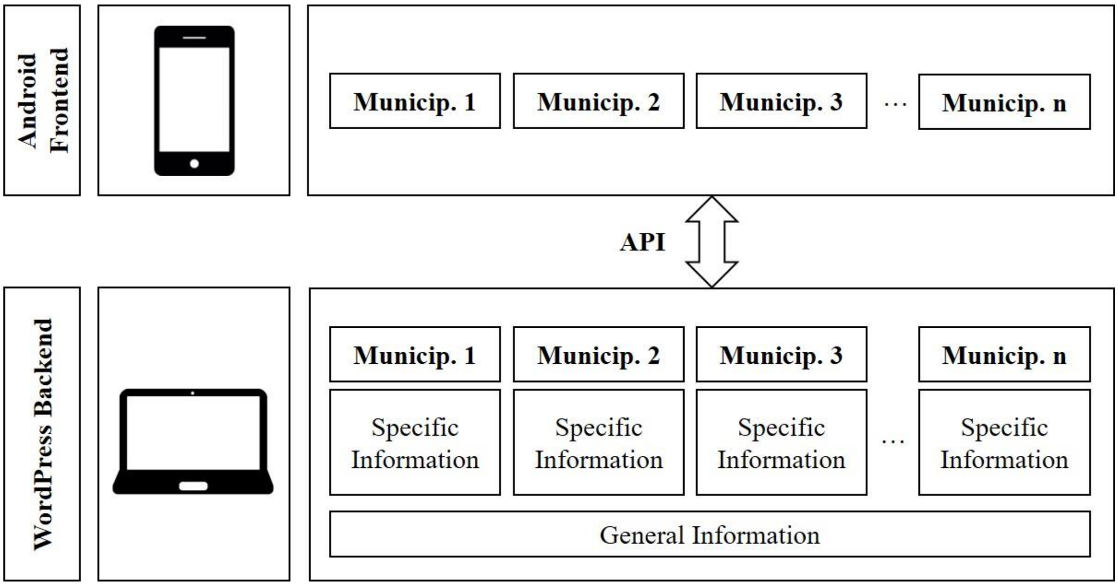

Figure 3. System architecture.

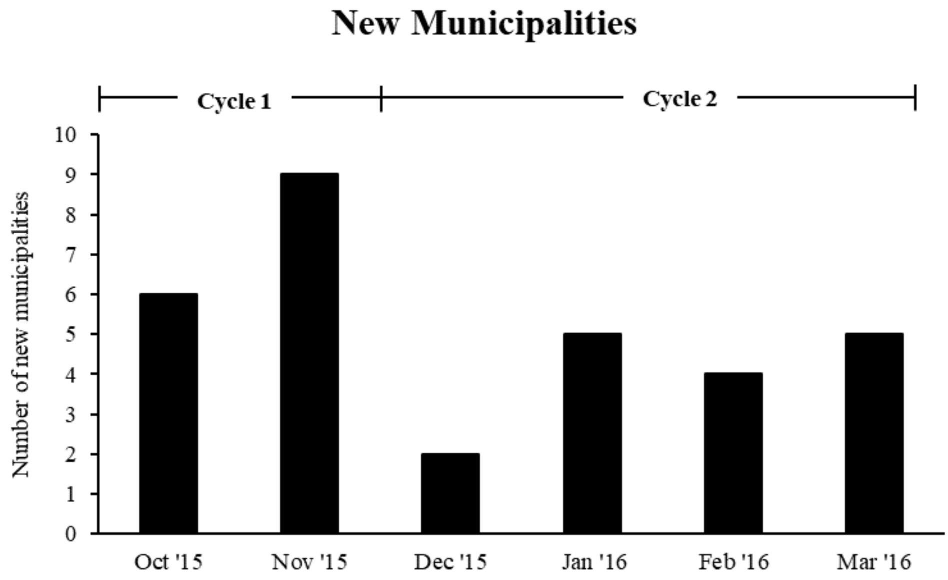

Figure 4. Acquisition of municipalities.

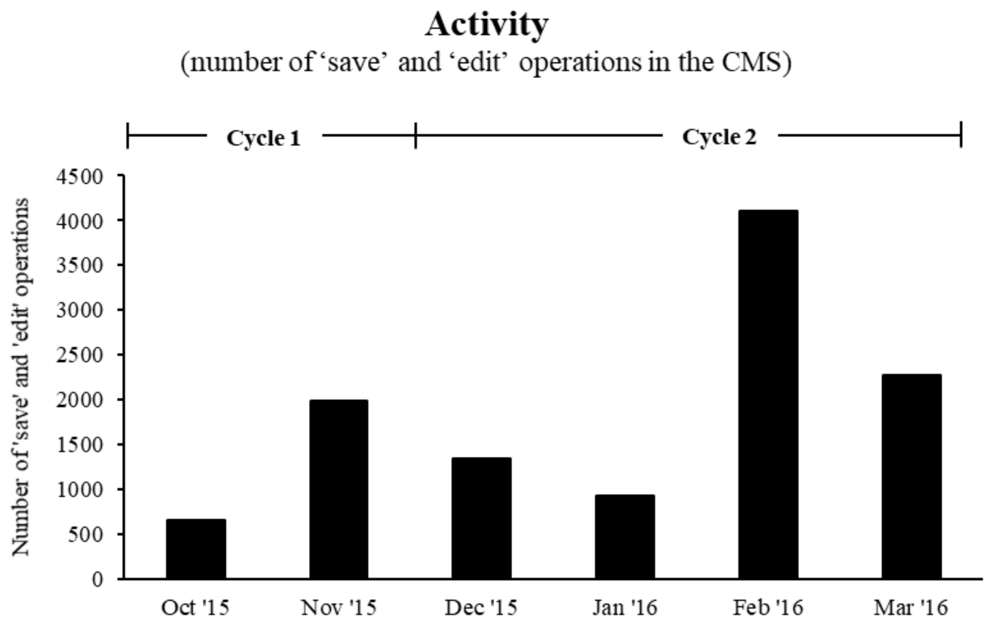

Figure 5. Activity on the platform.

Shifting to the Cloud – How SAP's Partners Cope with the Change

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Abstract[1]

With the advance of cloud technology, enterprise software vendors have introduced software platforms to facilitate third-party contributions to their ecosystems. This shift towards cloud-based software platforms affects ecosystem partners who have to adopt the new technologies, rethink their business model, and change their sales strategies. To understand how partners cope with this change, we conducted an exploratory case study within SAP's partner ecosystem after the introduction of a cloud-based software platform. By conducting 14 interviews within SAP and 10 partner companies, we identify three distinct coping strategies that partners adopt in the face of the shift to the cloud. Partners either (1) embrace, (2) slow down, or (3) repurpose the change. SAP in turn engages in mediation actions to increase the adoption of its platform and to alleviate possible negative impacts of the coping strategies. These mediation actions contribute to a continuous adjustment of SAP platform strategy. These findings contribute to literature on platform ecosystems by (1) highlighting that partners react differently to change in the ecosystem and by (2) shedding light on the interactions between platform owner and partners in the development of a platform strategy.

1 Introduction

In the enterprise software industry, collaborating with partners to offer end-to-end solutions to customers is a crucial part of vendors' competitive strategy [1, 2, 3]. With the advance of cloud technologies, the collaboration between enterprise software vendors and their partners changes. Instead of developing software extensions that are deeply intertwined with the core enterprise software, partners develop software-as-a-service (SaaS) applications that communicate with the core enterprise software through standardized application programming interfaces (APIs) [4]. Vendors transform their networks of strategic partners into platform ecosystems with a potentially unlimited number of third-party developers that provide complementary applications. As illustrated by Salesforce, a provider of enterprise software with a focus on customer relationship management, the implementation of a cloud-based software platform can spark innovative contributions by numerous third-party developers [5] and lead to sustained success. Furthermore, cloud-based ERP solutions promise advantages such as higher speed and availability and smaller up-front investments for customer, making the solutions more attractive for small and medium-sized enterprises [6].

However, existing partners of enterprise software vendors face challenges when a cloud-based software platform is introduced and the ecosystem shifts to the cloud. Partners have to migrate their own products and services to the cloud, change the provisioning of their services, and convince their customers to adopt these cloud offerings [7]. Coping with these changes is crucial for partners to survive the paradigm shift towards cloud technology. At the same time, the enterprise software vendors that act as platform owners need to understand how they can support their existing partners to cope with the change.

IS research is of limited help to understand the partners' challenges and coping strategies. Researchers have acknowledged the importance of partners for enterprise software vendors and have analyzed the relationship between vendors and their partners. Thereby, the focus lies on how platform owners govern the ecosystem of partners [8, 9, 10]. For the partners' perspective, mainly reasons of partners to join a platform ecosystem have been studied [3, 11, 12]. To enhance this understanding with regard to how existing partners react to ecosystem changes, we pose the research question: *How do partners of enterprise software vendors cope with the shift to a cloud-based software platform and how can the enterprise software vendor mediate these coping strategies?*

To address this question, we analyze the partner ecosystem of SAP after the introduction of a cloud-based software platform. We conducted 14 interviews within

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the partner ecosystem. We identified three distinct strategies applied by partners to cope with the shift towards a cloud-based software platform: Partners (1) embrace, (2) slow down, or (3) repurpose the change. We show that the platform owner applies mediation activities and thus adapts its platform strategy based on the partners' reactions.

These findings contribute to literature on platform ecosystems in the context of enterprise software by highlighting that third-party developers cope differently with technological changes in the ecosystem and that the platform owners need to address these differences as part of their platform governance. The results can prove helpful for both enterprise software vendors and their partners in practice. We illustrate specific measures how vendors can react to their partners' coping strategies during the introduction of a cloud-based software platform.

2 Theoretical Background

In this section, we describe our theoretical pre-understanding of the role of partners in the enterprise software industry and the increasing importance of platform ecosystems in that context.

2.1 Partner Ecosystems in the Enterprise Software Industry

Partners are important for the success of enterprise software vendors. Customers of enterprise software expect end-to-end solutions across their business processes, divisions, and countries of operation. To offer these end-to-end solutions, enterprise software vendors collaborate with partners that fill white spaces in their product portfolio with specialized expertise. For example, it is usually easier for vendors to rely on a local partner to implement country-specific tax regulations in an enterprise resource planning (ERP) tool than to implement it on their own. Furthermore, partners can support global sales and support activities or provide additional services such as consulting or customization of the standard enterprise software [1, 2]. As a result, enterprise software vendors have established ecosystems of partners that enhance their core offering [3].

Analyzing how partners engage in these partner ecosystems and how they interact with the enterprise software vendor is thus important for understanding success and failure of enterprise software. While IS research has acknowledged the importance of partners for the success of enterprise software [1, 3], studies mostly focus on the partners' decision to join an enterprise software ecosystem. Factors such as a platform's resources, its market access, leadership, and reputation have been identified to positively influence the partners' decision [11, 13, 14]. Uncertainty regarding market, technology, and the behavior of the involved actors represent factors that may inhibit participation of partners [14]. Focusing on the partners themselves shows that their downstream capabilities and intellectual property rights are indicators for partnership formation [12].

Once partners have joined an ecosystem, they have entered into a relationship with the enterprise software vendor. This relationship is coined by an interplay of trust and power that evolves over time [8]. Furthermore, technological, informational, and value-based asymmetries lead to challenges for partners [15] which they address with specific response strategies. In sum, IS research has started to focus on the role of partners in the enterprise software industry and their individual strategies to become a successful ecosystem partner.

2.2 Platforms in the Enterprise Software Industry

The advance of cloud technologies enables digital interconnection between products and processes within and across industries [16]. In the enterprise software industry, this development has led to the emergence of cloud-based software platforms. We define software platforms as "[…] the extensible codebase of a software-based system that provides core functionality shared by the applications that interoperate with it and the interfaces through which they interoperate" [17, p. 676]. The underlying change from monolithic to modular software architectures facilitates collaboration of the platform owner with third-party developers that create complementary applications within the platform ecosystem [17]. If the complementary applications are provided as software-as-a-service via the internet, we use the term cloud-based software platform (often referred to as 'cloud platform') [18].

Enterprise software systems have been referred to as platforms before as also on-premises software suites are extensible with partners providing numerous extensions to the proprietary core [3]. However, by relying on cloud technologies, more scalable platform ecosystems emerge. Instead of extensions that are closely integrated in the enterprise software's core, a cloud-based software platform provides an integration layer that separates the core from modular complementary applications. Thereby, the core often remains on-premises, only few companies have recently started to move their whole ERP software to the cloud. Communication between complementary applications and the core happens via standardized APIs [17] (Figure 1).

The resulting platform ecosystem is similar to those that emerged around software platforms in the context of smartphones (e.g., Google's Android [19]), video games (e.g., Sony Playstation [20]), social networks (e.g., Facebook Apps [21]), or smart home (e.g., Telefónica's BlueVia [22]). In all those platforms, third-party developers develop complementary applications that enhance the platforms core offering. The platform owner engages in platform governance to incentivize third-party developers to join the platform ecosystems and to control the activities within the platform ecosystem [17].

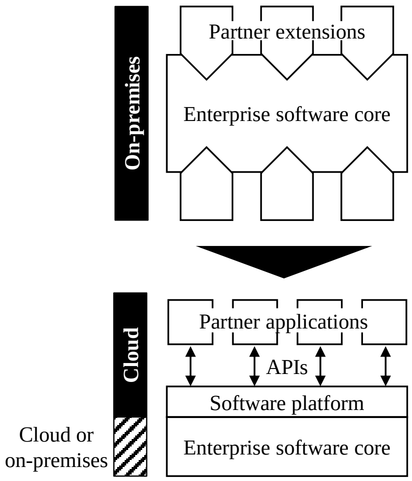

Figure 1: Shift from on-premises enterprise software to cloud-based software platforms

IS researchers have studied platform ecosystems with a focus on how platform owners set up and manage platform ecosystems. For example, researchers have analyzed the optimal degree of openness of software platforms [23], the balance of openness and control [24], or the role of boundary resources to facilitate value co-creation on software platforms [24, 25]. Fewer studies take on the perspective of third-party developers. Research focuses on third-party developers' decision to join or desert platform ecosystems [26, 27]. The situation of existing third-party developers who face a technological change in the ecosystem has not yet been analyzed. It thus remains an open question how partners of an enterprise software vendor react to the introduction of a platform and how the platform owner can address the different reactions.

3 Method and Case Selection

To explore how partners of an enterprise software vendor react to the introduction of a cloud-based software platform, we empirically study the case of SAP that has established a platform as extension of its ERP system.

3.1 Exploratory Case Study

We chose an exploratory case study approach [28] for two reasons, following Urquhart, Lehmann [29]. First, the introduction of a cloud-based software platform in the enterprise software industry is a complex and dynamic phenomenon. It is related to interactions between various stakeholders such as the platform owner and its partners. To grasp that complexity, it is helpful to study a specific occurrence of the phenomenon in its context while continuously getting back and forth between data collection and analysis. Second, theories in the context of platform ecosystems are still in an early stage [cf. 30]. Thus, it would be difficult to develop a theoretical framework and formulate hypotheses upfront, in particular in view of the heterogeneity of partners in the enterprise software context.

We chose the case of SAP because SAP is a leading provider of enterprise software who has established a cloud-based software platform in recent years. SAP has a large network of existing partners that were affected by the introduction of the platform. Thus, the case is suitable to analyze how partners reacted to the technological shift in the ecosystem.

3.2 Data and Analysis

For studying our case, we followed grounded theory methodology procedures for data collection and analysis [31, 32]. We collected qualitative interview data, selecting our interviewees based on theoretical sampling considerations. We started with interviewees at partner companies that had already adopted the platform. To better understand differences between partners and their strategies, we selected further interviewees at partners that had not yet implemented an offering on the platform but had evaluated doing so.

We conducted semi-structured interviews with decision makers at partner companies and with key employees of SAP in the context of its platform [33]. In total, we conducted 14 interviews within the ecosystem of the platform between October 2017 and May 2018. The interviews lasted about an hour on average. The interview questions covered the relationship between SAP and its partners, the challenges both sides faced related to the shift to the cloud along with the strategies how they faced these challenges.

In addition to interview data, we gathered rich secondary data. The first author participated in a full day workshop organized by an SAP partner association with more than 100 participants and was able to validate the results in numerous informal conversations and within a workshop session on cloud adoption. We furthermore analyzed partner agreements and videos from developer conferences. We provide details on the data sources we relied on for the exploratory case study in Table 1.

Table 1. Overview of Data Sources

Primary Data: Interviews		
Organization	**Description**	**Interviewee**
SAP	Multinational software company focusing on ERP software	• Product owner of SAP's platform • Developer from the platform team
Partner#1	Consultant partner with focus on ecosystem strategy and go-to-market	Founder/CEO
Partner#2	Global IT consulting company, including SAP's portfolio	Project manager
Partner#3	Consultant partner with focus on ecosystem strategy	Founder/CEO
Partner#4	SAP partner with focus on business intelligence	• CEO • Project manager
Partner#5	Multinational IT provider offering and enhancing the SAP product portfolio	• Partner manager for SAP • Project manager
Partner#6	Small partner focused on managed business applications	CEO
Partner#7	IT consultancy with focus on the insurance industry	Project manager
Partner#8	Multinational IT provider and consultancy with focus on the insurance industry	Project manager
Partner#9	Global full stack IT provider offering and enhancing SAP's portfolio	Manager for SAP service offerings
Partner#10	US-based provider of IT services, including IT consulting and operations services	SAP alliance manager
Secondary Data		
Type	**Description**	
Partner workshop	• Full-day workshop in May 2018 with approximately 100 participants from the partner ecosystem • Discussion of preliminary results in a workshop session and informal conversations	
Documents	• 55 documents (partner agreements, guidelines, price lists) • 5 videos from developer conferences (2.5 h)	

To analyze or data, we first created open codes related to different activities and decisions of SAP and its partners [31, 34]. Then, we clustered open codes into subcategories. These subcategories covered different manifestations of how partners coped with the introduction of the platform and how SAP reacted.

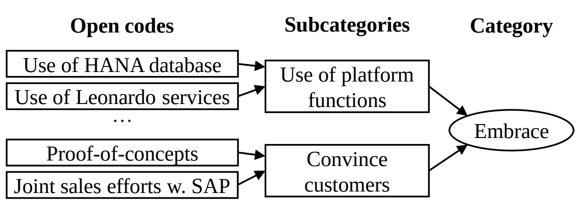

Figure 2: Excerpt from coding scheme

We then grouped these subcategories to four core categories that describe distinct coping strategies of the partners and mediating activities of SAP. Finally, we conducted theoretical coding to relate the partners' coping strategies with the platform owner's mediation strategies. Excerpts from the coding scheme related to the category "enable" as a coping strategy are shown in Figure 2. Throughout the coding process, we applied the principle of constant comparison [29], that is, we confirmed relationships that emerged in the selective coding step by getting back to the data and the open codes.

4 Case Description: SAP's Shift to the Cloud

SAP is a multinational software company focusing on ERP software. SAP collaborates with numerous partners to develop, run, and sell its enterprise software. As customers expect end-to-end solutions for their business processes, SAP faces a huge number of heterogeneous requirements across partners, industries, and countries. For example, SAP needs to fulfill requirements of industry-specific processes as well as country-specific regulations. Partners can help SAP to address these specific requirements, as the product owner of the platform illustrates:

"[…] the fundamental motivation [for partnering] is that our portfolio does not cover end-to-end, thus, extending our services with partners is important. The customers want an end-to-end process. Therefore, it is necessary to integrate third parties into the process. […]"

In early 2013, SAP has established a cloud-based software platform for third-party applications that extends the enterprise software core provided by SAP. The platform provides APIs and a software development kit (SDK) that grant developers access to functions such as production data analysis or forecasting algorithms and support them in developing applications. As a result, an ecosystem of third-party developers has emerged on the platform:

"Based on the [platform], new applications, apps, as well as extensions of existing applications can be built in the cloud. […] Somewhat like an innovation layer for established, rather slowly ticking systems of SAP. […] I think this is the benefit one could see, because we not only enable customers to do this but we also enable partners to develop such applications on the platform and this in turn creates an ecosystem." (product owner of SAP's platform)

SAP expects its existing partners to adopt the platform by migrating their extensions to the cloud or developing new cloud applications. According to SAP, its platform has many advantages for the partners. First, it is open to various common technologies such as programming languages or database technologies. In former on-premises environments, partners mostly had to use SAP's proprietary technologies for developing extensions. Second, the platform comes with a plethora of services that can be used by partners, in particular in the context of business analytics, Internet of Things (IoT), and machine learning. Third, by offering applications on the platform, partners can directly reach a global customer base of SAP users.

However, shifting to the platform entails major changes for partners. From a technical perspective, partners need to work with new technologies, in many cases technologies that the current employees are not familiar with. From an organizational perspective, providing software as applications on a platform needs a reconfigured business model and sales approach. At the same time, there still is uncertainty in how far the platform is consistent with what the partners' customers want. As a result, partners develop different strategies how to cope with the changes that the platform comes along with.

5 The Partners' Coping Strategies

In our study, we identified three coping strategies that partners applied when SAP introduced its cloud-based software platform. Partners (1) embraced, (2) slowed down, or (3) repurposed the change that was triggered by the platform (Table 2).

Table 2: Partner Coping Strategies

Coping strategy	Description
Embrace	Partners adopt the platform early and create innovative partner solutions on the platform. *Manifestations:* • Partners offer applications in the platform's app store and leverage state-of-the art technology provided by the platform • Partners promote and sell the platform to their customers by demonstrating use cases • Partners actively provide feedback to improve the platform
Slow down	Partners hesitate to adopt the platform and try to slow down the change. *Manifestations:* • Partners promote the advantages of the existing, non-platform solution that is still used by the majority of their customers • Customers hesitate to adopt the platform, leading to a chicken-egg-problem
Repurpose	Partners use the platform for purposes that are not core of SAP's platform strategy. *Manifestations:* • Partners use the platform as toolbox for customer-specific developments instead of modular cloud apps • Partners engage in consulting to facilitate onboarding in the platform ecosystem

5.1 Embracing the Change

A group of partners embraced the introduction of the platform as a long overdue move to increase the competitiveness of SAP and its partner network as a whole. Those partners value the opportunity to use state-of-the art technologies to provide innovative solutions to their customers. As a result, these partners were the first of the existing partners to develop applications for the platform. We observe different manifestations of activities and decisions that are part of the embrace strategy.

First, partners adopting the embrace strategy generally have already provided an innovative application in the platform's app store. To do so, they often use the innovative services available on the platform as out-of-the-box tools. A global IT provider that offers and enhances SAP's portfolio illustrates:

"In digital transformation projects with our customers, we are working intensively on what we call "Innovation by add". In these projects, the core process is still mostly running in the standard systems and the "Innovation by add" runs on the [platform]. […] As an example, when it comes to monitoring vibration of machines, we attach vibration sensors to machines, record the vibration pattern, transmit them to the [platform], and learn from them with machine learning. We also have the opportunity to monitor the machines and make a maintenance order if something has to be changed on these machines. It's actually these cloud extensions that help the customers to transform."

Second, partners actively promote the platform to their customers. By preparing and demonstrating use cases that the customers can relate to, the partners can illustrate the value of the platform. The above quote shows that the partner presents *"Innovation by add"* cloud applications to the customer who then decides whether that use case is beneficial for them. If so, the implementation of the use case comes along with an implementation of SAP's platform, sold by the partner acting as SAP's reseller. Thus, partners that embrace the change directly contribute to the sales of the platform.

Third, we observed that partners who adopt the platform early also actively engaged in a dialogue with SAP to improve the platform. According to some partners, the platform was launched at a rather early stage and benefitted a lot from the feedback the partners provided:

"Well the technical maturity of the [platform] is a matter of debate […]. We developed on the [platform] from the very beginning […] and obviously, a lot was still missing, we don't need to sugarcoat that. […] But, we generally collaborate closely with SAP, we have weekly sync calls and we discuss these issues." (project manager of a large IT consulting firm)

5.2 Slowing Down the Change

A second group of partners hesitated to adopt the platform and even engaged in activities to slow down the change. A paradigm shift such as the shift to the cloud is a longsome endeavor in the enterprise software industry because many customers have legacy enterprise software and follow a "never change a running system" strategy. Furthermore, still many companies fear losing control over their data when using cloud software. As a result, according to a survey of a large user group, only 9 % of the surveyed companies plan to invest in SAP's cloud-based enterprise software suite in 2018.

Partners who currently are successful by customizing the SAP on-premises products and developing extensions for them thus have little incentive to switch to the cloud-based software platform as long as enough customers stick to the on-premises solution. The CEO of a consultancy with focus on ecosystem strategy highlights:

"After all, many customers have a bit of skepticism about the cloud, they see data loss and consider the whole thing from a risk perspective – especially SMEs [small and middle-sized enterprises], which are widespread in Germany. Usually their IT department wants to keep sovereignty over their data and processes. That's why, of course, partners slowed down a bit because when their customers are not asking for a cloud, it's hard to tell them that cloud is the right answer for the use case and the problem."

Partners even go further by promoting the benefits of the older non-platform solution to their customers while keeping quiet about the potential of the cloud solutions. In particular, small and middle-sized customers do not have direct communication with SAP but rely on partners to suggest and implement solutions. This creates trade-offs:

"There are many add-ons that are out-of-date but the customer is still happy with them. In some cases, the functionality now is part of the standard SAP platform offering, meaning the customer would not need the add-on any more. But the customer has to realize that and then still has to implement the new cloud-based solution. This would be probably done by the same partner who developed the old add-on in the first place – but this partner is still earning money with the add-on. The partner won't say 'trash the add-on and switch to cloud component X'. You can see the conflicts created here." (CEO of consultancy for SAP partners and customers)

This leads to a chicken-egg-problem: small and medium-sized companies hesitate to adopt cloud solutions, thus the SAP partners they work with do not promote cloud solutions to them. As it is mostly the partners who have the voice towards the small and medium-sized customers, it is hard for SAP to break that cycle.

5.3 Repurposing the Change

A third group of partners used the platform but did not implement complementary applications, which is the main purpose of the platform according to SAP. We observed two manifestations of how partner repurposed the introduction of the platform to benefit from it. First, partners used the platform as a toolbox for customer-specific developments instead of developing applications and offering them in the platform's app store. Partners emphasized that cloud applications are not suitable to implement processes related to a customer's competitive advantage:

"With software-as-a-service offerings, what use cases can you cover? Those that are not unique selling points of companies. […] there is a gap between core processes and what really is the unique selling point of a company. And for this gap, I see custom development happening also in the long run, that interacts with software-as-a-service products." (project manager of a large IT consulting firm)

Furthermore, sales of customer-specific projects on the platform is easier for partners because it is similar to the sales approach the partners used for on-premises projects. Selling cloud applications through the platform's app store would ultimately require changes to the partners' business models. Therefore, some partners use small cloud applications that are listed in the app store as way to attract customers for customer-specific projects but not as a scalable sales channel for a generic app.

A second manifestation of the repurposing strategy refers to partners that offer consulting services for other partners that want to onboard the platform. According to SAP, onboarding has become much easier with the platform because applications can be implemented and marketed faster. However, the ecosystem around the platform is complex due to its history of technological changes and acquisitions and makes it difficult for partners to find the best strategy. One partner summarizes:

"Then, the cloud products came but unfortunately they were rather complex. First there was the [1st generation platform], then the [ERP in the cloud] and now the [2nd generation platform]. And that is confusing because those are not the only cloud products of SAP as SAP by now has acquired several firms such as [cloud solution for procurement], which also is a cloud platform, [cloud application for travel management] which is a software-as-a-service offering and [cloud-based ERP for SMEs] which is also marketed as cloud solution."

Consequently, consultancies have specialized in supporting partners to develop a cloud offering based on SAP's platform. For example, they provide frameworks and boilerplates based on the platform's boundary resources to develop applications more quickly. The CEO of such a consultancy summarizes:

"We have created a 'mini ecosystem' to enable SAP's partners to develop native apps for the cloud platform. We take care of the onboarding, legal implications, licensing issues, and the choice of an operating mode."

Such 'mini ecosystems' are inconsistent with SAP's effort to create a harmonized ecosystem on its platform. They create additional dependencies for partners, making the ecosystem more complex – which in turn can increase the perceived need of partners for additional consulting services.

6 The Platform Owner's Mediation Activities

In an ideal situation, all partners would adopt an embracing strategy with regard to SAP's platform. However, impressions from our interviews as well as from a partner workshop with more than 100 participants show that many partners slow down or repurpose the change introduced by the platform. SAP thus tries to identify mediation activities to also benefit from partners that embrace the platform and to help partners that do not use the potential of the platform (Table 3).

Table 3: Mediation Activities

Coping strategy	Related mediation activities
Embrace	• Evaluate and implement suggestions for improvement • Leverage as use cases to illustrate benefits of the platform to other partners
Slow down	• Build illustrative use cases with partners and end-users • Engage in dialogue with partners to understand adoption barriers • Increase pressure for adoption
Repurpose	• Adapt the platform strategy to provide enhanced support and tools for customer-specific development • Reduce complexity of cloud offering, particularly regarding licensing and resource provision

To benefit from partners that embrace the implementation of its platform, SAP engaged in two main activities. First, SAP evaluated the partners' feedback on the platform and implemented some of their suggestions. Thereby, SAP focused on large partners as they have direct communication channels. Asked about whether SAP incorporated their feedback, a project manager of one partner stated:

"You just need to look into the release notes. One example: We built a micro-service landscape and one specific issue was the versioning of micro-services, how can you do that and how does that work well with continuous delivery. We discussed that with SAP and then they wanted our feedback on their proposed solution and now, since a few weeks ago, there is an out-of-the-box versioning of artefacts built in the platform SDK's [software development kit] delivery pipeline."

Second, SAP leveraged use cases of partners that established an innovative cloud application as success story to incentivize other partners. These success stories are then shared on the website, at developer conferences, or directly with partners. For example, at the developer conference in 2017, an on-stage interview with a provider of solutions for human resource management showcased the success of the cloud application the provider had launched.

Partners that adopted a slow down strategy with regard to the platform required more of SAP's attention. To convince those partners to adopt or at least try out the platform, SAP built illustrative use cases with those partners that were already on the platform. Thereby, SAP could demonstrate that the platform enables new business models for partners. Furthermore, SAP engaged in a continuous dialogue with partners through various feedback channels such as developer conferences and partner events and direct exchange with partner managers. But SAP also increased the pressure on its partners to adopt the platform for example by announcing discontinuation of support for certain on-premises solutions.

For partners that repurpose the shift towards the platform, SAP has engaged in two mediating activities. On the one hand, SAP has acknowledged the role of the platform for customer-specific developments and has adapted the platform strategy to provide more support and tools for customer-specific development. For example, by continuously increasing the technological openness of its platform, SAP has made it easier for partners to use the platform as a toolbox. A developer from SAP's platform team summarizes:

"[…] we are more open with the [platform] because [we] know we cannot deliver top of the breed in every aspect and there are a lot of strong open source communities developing simple things like a syntax highlighted editor […] but also complex things that allow you to do machine learning and NLP [non-linear programming] […]. And [the platform] really offers you the capability to deploy such modules – sometimes written in node [node.js; JavaScript], sometimes written in

Java. […] [the platform] is really opening up and moving away from the trend of just allowing [proprietary languages] […] and that is the openness we provide.“

On the other hand, SAP is trying to reduce the complexity of its platform ecosystem. For example, SAP rebranded the platform in 2017 to harmonize the ecosystem, from the nomenclature of services to pricing for resources. In this process, SAP can benefit from the experiences of the consulting firms that currently help partners to onboard the platform.

7 Discussion

The insights of our case study show that partners of enterprise software vendors adopt different coping strategies with regard to the shift to the cloud. Partners embrace, slow down, or repurpose the implementation of a cloud-based software platform. The platform owner then can engage in mediation activities to address these reactions. These findings contribute to IS literature on platform ecosystems, in particular to recent work on the emergence of platform ecosystems and the role of partners for platform strategy in the enterprise software industry.

7.1 The Process of Partner Migration to the Cloud

The findings of our case study show that not all existing partners of a company adopt a newly introduced platform in a straightforward way. Instead, migration of partners onto the platform is a process that includes partners' coping strategies and the platform owner's mediation activities, in some cases leading to a partner dropping out of the ecosystem (Figure 3).

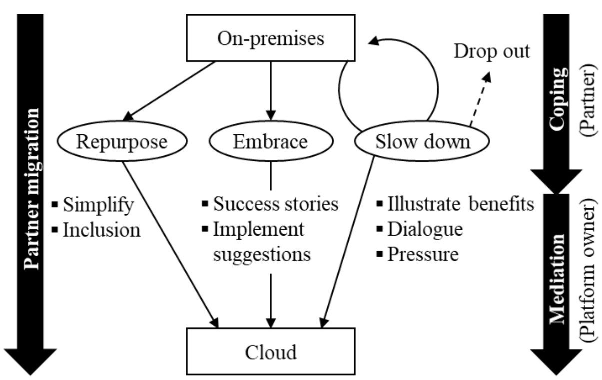

Figure 3: Process of partner migration to the cloud

Partners are important for companies in the enterprise software industry [1, 2], thus it is important to keep existing partners during the shift to the cloud. Existing partners can be of more value than new partners because they have their own customer networks and know-how to best combine their solutions with the offering of the enterprise software vendor. It is thus not only important to understand how new partners can be incentivized to join the platform ecosystem [11, 13, 14] but also to understand how existing partners can successfully migrate. Yet, there might be partners who are so reluctant to adopt the platform that their slow down strategy negatively affects the growth of the ecosystem. In those cases, it is be best for the platform owner to let them go.

The process of partner migration to the cloud represents an aspect of platform governance that companies such as enterprise software vendors need to incorporate in their governance strategy when implementing cloud-based software platforms. We thereby enhance literature on platform governance [e.g., 17, 35] that mainly focus on established platform ecosystems.

In practice, this process view on partner migration helps enterprise software vendors to increase the adoption of a platform among its existing partners. The first step is to acknowledge that partners react differently to the change and that the platform owner needs to take different actions to support them. In a second step, the enterprise software vendor can improve the platform by carefully observing why partners want to slow down the change or how they repurpose the platform.

7.2 The Impact of Repurposing on Platform Strategy

Another finding of our study is that a large share of the partners repurposed the platform and used it for customer-specific developments instead of implementing software-as-a-service applications. This had an impact on the platform owner's platform strategy and its platform governance.

Customer-specific development decreases the scalability of the platform ecosystem, as it does not trigger network effects. While cross-side network effects are typical for software platforms and a key to their success [36], customer specific projects usually are not visible to other ecosystem participants, thus they do not incentivize other customers to join the platform. As a result, despite a high number of partners using SAP's platform, the number of applications available in the app store is still lower than in other competing platform ecosystems.

It became clear that partners who repurposed the platform still contributed to an increased adoption of the platform and were of significant value for the platform owner. SAP thus adapted its platform strategy to incorporate customer-specific development on the platform. For example, SAP increased the compatibility of the platform with the company's proprietary programming language used typically used for on-premises projects. However, SAP still struggled to find an approach to platform governance that incorporates both partners that develop software-as-a-service applications and partners that develop customer-specific solutions.

First, the two groups of partners require different boundary resources. Partners that develop customer-specific solutions need more support for different programming languages and frameworks to integrate heterogeneous legacy systems. For partners that develop software-as-a-service application, leaner, more standardized boundary resources can prove more useful [37].

Second, customer-specific developments are not subject to output-oriented control mechanisms such as quality checks as they are not submitted to the app store [38]. In order to not jeopardize the platform's reputation, the platform owner needs to identify other means to ensure quality, for example through mandatory participation in partner programs.

8 Limitations and Future Research

Our study is subject to limitations. First, generalizing results from single case studies is challenging. We have studied an enterprise software vendor with a focus on enterprise resource planning. In other context such as the industrial Internet of Things [39] or the banking industry [40], relationships between partners and platform owners could have different characteristics. Second, our study covers a relatively short period. While interviewees mostly have shared insights into partner's coping strategies, a longitudinal perspective could help to carve out more details of a migration process and to understand how partners adjust and adapt their coping strategies.

We suggest two avenues for future research. First, it would be worthwhile to analyze what characteristics of partners are linked to different coping strategies. This could help platform owners to apply mediation activities precautionary and to increase platform adoption. A second research theme relates to how platforms need to be designed and governed to enable both software-as-a-service applications and customer-specific development [35]. Tradeoffs regarding boundary resources or control mechanisms arise that platform owners, particularly in business-to-business context, need to consider.

9 References

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