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*Document Version*

Final published version

*Published in:*

ICIS 2016 Proceedings

*Publication date:*

2016

*License*

Unspecified

*Citation for published version (APA):*

Hahn, C., Huntgeburth, J., Winkler, T. J., & Zarnekow, R. (2016). Business and IT Capabilities for Cloud Platform Success. In *ICIS 2016 Proceedings* Association for Information Systems. AIS Electronic Library (AISeL). <http://aisel.aisnet.org/cgi/viewcontent.cgi?article=1189&context=icis2016>

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Download date: 06. Jul. 2025

# Business and IT Capabilities for Cloud Platform Success

*Completed Research Paper*

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## Abstract

*The growing proliferation of cloud platform ecosystems demands a deeper understanding of the capabilities that help existing and emerging platform providers to be successful by creating and appropriating value. This multiple case study of four cloud platform providers (three large, one SME) instantiates Rai and Tang's (2014) framework of dyadic IT and network IT capabilities for a cloud platform context and extends it by exploring previously undertheorized cloud platform business capabilities. We further build on this extended framework by employing a configurational perspective to elucidate the complementary role of the three proposed business capabilities (incentives and rules, ecosystem marketing and sales, partner development and support) for relevant value creation and appropriation mechanisms. In addition to providing a capability framework catered to the cloud platform context, our findings are summarized in a set of four propositions that jointly contribute to emerging cloud platform research in IS.*

**Keywords:** Cloud Platform Ecosystems, Value creation, Value Appropriation, IT capabilities, IT-enabled business models, Exploratory multiple case study

## Introduction

Cloud computing platforms are one of the most important trends currently pushing into the e-business field (Cusumano 2010a, 2010b). Cloud natives like the Google Cloud Platform, Microsoft Azure, Salesforce App Cloud are investing heavily to achieve and maintain leadership positions in different segments of consumer and enterprise software, while traditional enterprise software providers in the business-to-business (B2B) segment react by transforming their business models into service-centric approaches, overall resulting in a predicted US\$ 22 bn. market for Platform as a Service (PaaS) in 2019 (Carvalho et al. 2015). A *cloud platform* (or PaaS) generally refers to a software execution environment wherein external developers deploy and run their complementary components, impacting the way that software is produced, distributed, consumed, and priced (Giessmann and Stanoevska-Slabeva 2012). Success of platform ecosystems in other areas, e.g., for mobile phone apps, has raised attention to the question how platforms can excel in developing and leveraging IT capabilities to create value with partners and appropriate this value to the platform (Basole and Karla 2011). To date, however, we still lack insights on which are the relevant capabilities of cloud platforms and what is their role for value creation and appropriation in these rapidly emerging ecosystems, although such understanding would be valuable for existing and emerging cloud platform providers to compete.

The emerging platform ecosystems literature in IS has emphasized that value is co-created on platforms through the combined and integrated offerings of multiple ecosystems participants (Huntgeburth et al. 2015; Sarker et al. 2012). Hence, the incentive to participate in an ecosystem lies in the generation of performance by leveraging complementary assets that are being made accessible through the platform (Adner and Kapoor 2010; Iansiti and Levien 2004; Thomas et al. 2014). Although it is self-evident that IT capabilities are likely to play a critical role in IT-enabled business models (e.g., Amit and Zott, 2012), instantiations of IT capabilities will vary in specific contexts (Rai and Tang, 2014), out of which cloud platforms are one contemporary example.

In addition to the importance of IT capabilities, prior business model research also points us to the importance of understanding the complementary business actions required to successfully establish a platform (Thomas et al. 2014). Here, the literature has particularly stressed the trade-offs between value creation and appropriation determined by business actions, such as, managing the degree of openness and control (Tee and Gawer 2009) or building a vibrant and supportive partner ecosystem (Gawer and Cusumano 2014; Jansen et al. 2012). Without complementary business capabilities, platform owners may have difficulties to pursue their value creation or capture strategies (Yoo et al. 2012). Since such business capabilities are likely to interact with a platform's IT capabilities, more awareness is necessary to identify conditions that indicate a successful configuration of both types of capabilities (Yoo et al. 2010).

IS research has highlighted the strong mutual interdependence of the business context, IT capabilities and organizational capabilities to build a strategic advantage (El Sawy et al. 2010). Given the crucial role of context for organizational behavior, scholars have highlighted the need for context-specific theory development (Johns 2006). Thus, given the lack of prior research on capabilities of cloud platforms, and the presumed, but undertheorized importance of business capabilities for platform success, we aim to address the following two exploratory research questions:

*RQ1: What are the B2B IT and business capabilities in cloud platform ecosystems?*

*RQ2: What is the role of B2B business capabilities in value creation and value appropriation in cloud platform ecosystems?*

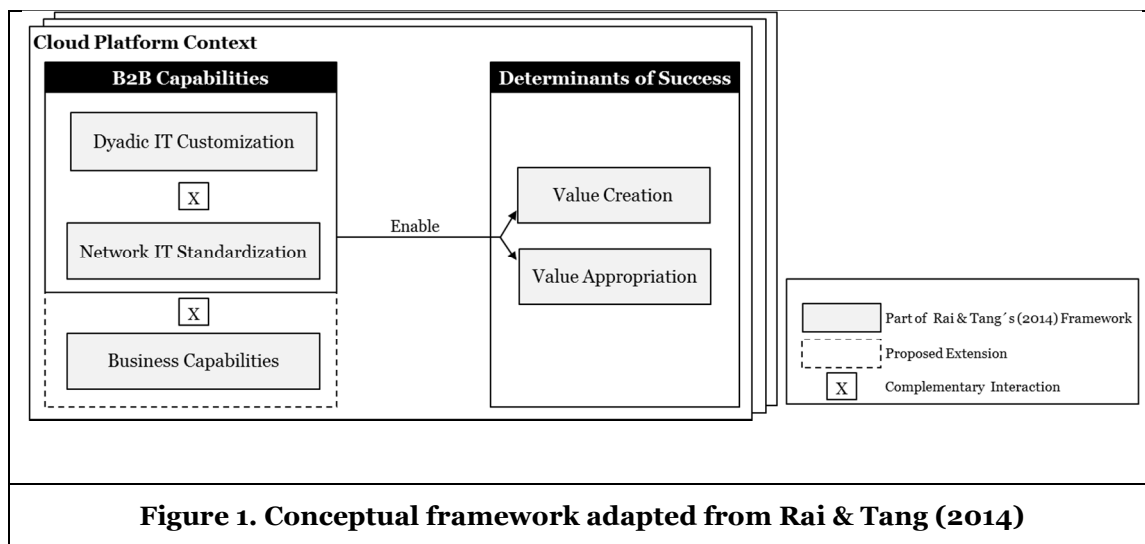
This research utilizes a multiple case study (Eisenhardt and Graebner 2014) and employs a configurational perspective (El Sawy et al. 2010) to look at simultaneous interconnections of business and IT capabilities that lead to value creation and appropriation. Building on the wider literature on platform ecosystems and qualitative data from four cases of cloud platform providers, we first apply deductive and inductive cross-case analysis techniques to identify relevant sub-categories of business and IT B2B capabilities in cloud platform ecosystems as well as additional sub-categories of value creation and value appropriation mechanisms. Then, based on a focused analysis of those configurations of business and IT capabilities that were successful for single value mechanisms, we develop four propositions that characterize the different ways of how B2B platform business capabilities complement specific IT capabilities. We argue that the resulting framework of B2B capabilities and the four propositions extend

prior platform ecosystem research by showing that business capabilities play a vital role in creating and appropriating value as well as by demonstrating that the configurational perspective can be a valuable lens for analyzing this complex interaction. Moreover, our findings may also provide insights for other types of B2B platform ecosystems.

## Theoretical Background

In line with Thomas et al.'s (2014) platform ecosystem definition, we understand a *cloud platform ecosystem* as a coordination structure for a broader network of businesses (the ecosystem) which supports value co-creation through complementary offerings around a set of shared core technologies (the cloud platform) (Gawer and Cusumano 2008, 2002). The cloud platform represents an extensible codebase of a software-based system which provides core functionality and shares its functionality with modules through interoperable interfaces (Tiwana et al. 2010). The facilitation of value creation through complementary assets is associated with control mechanisms such as granting levels of access (Boudreau 2010) or standard setting (West 2003). As a consequence, the platform ecosystem may possess a diversity of ownership and control mechanisms over the platform services and complementary assets (Gawer and Cusumano 2002; Gawer and Henderson 2007). The organization at the center of an ecosystem (the cloud platform provider) requires special capabilities to find adequate IT-enabled, multi-sided business models that use cloud technology to connect the various platform partners (i.e., customers and complementors) and succeed in the market (Boudreau and Hagiu 2008; Evans 2013; Hagiu 2014).

In their meta-study of IT-enabled business models, Rai and Tang (2014) propose a descriptive framework of how business value (created and appropriated) derives from IT capabilities. *Value creation* refers to the total value generated for the focal firm (i.e., the platform provider) and all other stakeholders (i.e., customers or complementors). The total value sets the upper limit for the value that can be *appropriated* by the platform (Brandenburger and Stuart 1996). Given that this framework has remained undisputed in explaining the role of IT capabilities for the success of an IT-enabled business, we utilize the categories of this framework as a theoretical starting point of our case analysis and extend it through further literature and empirical work. Figure 1 displays the main categories of our (extended) conceptual framework, for which we review the supporting literature, foreshadowing some of the key concepts of our study (key concepts highlighted in *italics*, see also later section 4).



### Determinants of Platform Success – Value Creation and Appropriation

In terms of value creation, the literature emphasizes three main value creation mechanisms: *novelty*, *efficiency*, and *complementarity* (Amit and Zott 2001). *Novelty* refers to creating new ways of conducting economic exchange through linking transaction participants (Zott and Amit 2007). In the context of cloud platform ecosystems, prior researchers have explored how cloud marketplaces serve as new sales channels thereby changing the transaction and distribution structure of traditional enterprise software (Beimborn

et al. 2011; Novelli and Wenzel 2013). *Efficiency* represents the value created through streamlined transactions and coordination activities (Zott and Amit 2007). In platform ecosystems, this can be achieved through standardizing processes and information flows such as the coordination of activities with complementors (Beimborn et al. 2011; Markus and Loebbecke 2013). *Complementarity* refers to creating value from integrating provider assets with partners' assets to generate indirect network effects (Rai and Tang 2014). In platform ecosystems, complementarity can refer to innovative applications that are enabled by platform services (Boudreau 2011), e.g. through mashing-up 'building blocks' (platform services) and strive for combinatorial innovation (Yoo et al. 2012).

Teece (2010) suggests three mechanisms of value appropriation: bundling, lock-in, and barrier to imitation. *Bundling* can be described as the strategy of selling a collection of products and services for a fixed price (Sirmon et al. 2008). Platforms can be described as bundles inasmuch as they offer core services and components together (Eisenmann et al. 2006; Thomas et al. 2014). *Lock-in* prevents customers and strategic partners from switching to competitors (Zott and Amit 2007), which may be other cloud platforms or independent software vendors. The *lock-in* of customers and complementors through proprietary technology or strategic design of products is a mechanisms known from technology platforms (Ballon and Van Heesvelde 2011). Through locking-in customers on a platform, revenue streams are extended and value is sustained. *Barrier to imitation* aims at deterring or delaying competitors from copying the platform's product or service offerings by seeking strong intellectual property protection, for example through patents or copyrights (Rai and Tang 2014). Proprietary technology (specific services or connectors) that is protected by IP rights would deter other platform providers from entering the market (Huang et al. 2012).

### ***Supporting Literature for IT Capabilities in Platform Ecosystems***

Capabilities represent a concept from organizational research including the streams of the resource based view (Barney 1991) and its later extension towards dynamic capabilities (Teece et al. 1997). Building on these streams, B2B IT capabilities have been defined as the "ability to manipulate the firm's digital network of information in order to create, control and execute interfirm transactions" (Kim and Mahoney 2006; in Rai and Tang 2014, p. 5 ). Prior research has focused on IT capabilities in intrafirm contexts, which Wade and Hulland (2004) categorized broadly as outside-in, inside-out, and spanning capabilities. In the context of ecosystems, Rai and Tang (2014) argue that there are two broad categories of IT capabilities that are needed for functioning at distinct levels: (1) IT customization at the dyadic interfirm level, and (2) IT standardization at the network (i.e., the overall ecosystem) level.

*Dyadic IT customization* considers idiosyncratic (i.e., relationship specific) requirements in single provider/partner relationships for its governance, transaction structure, and information sharing. Examples include build-to-order interfaces to exchange custom information and/or tailor business rules and processes (Broadbent et al. 1999; Turnbull 1991). In the context of the wider platform literature, dyadic IT capabilities relate to solving essential system or business problems of the partners when providing the core of the platform. Such problem solving can comprise the provision of complementary modules as described by Gawer and Cusumano (2014, 2008). As such, *onboarding* and *integration* of complements can be described as a dyadic capability further including organizational aspects such as quality assurance and organizational agreements (see e.g. Axelsson and Skoglund 2015). Another dyadic factor described to be relevant is *support* and *consulting services*. In their work on open software ecosystems, Jansen et al. (2012) found, for example, that support and consulting are an important capability which increases a complementors' satisfaction.

*Network IT standardization* describes a platform's contrary capability to leverage common processes for data exchange and IT modularization in order to standardize activities and facilitate information exchange. Thereby the need for relationship specific investments can be alleviated (Malhotra et al. 2007; Ross and Beath 2006). *Process standardization* in this context relates to standardizing information flows such as product descriptions, invoicing information, as discussed in the wider B2B literature (see e.g. Muylle and Basu 2008). With regards to software platforms, Jansen et al. (2012) also identified the need to standardize the processes for developing the complements. Prior research has discussed the suitability of commoditized business processes over standardized processes in digital platforms (see e.g. Markus and Loebbecke 2013). Further, recent literature highlighted the need of *modularization* in platform architectures (Baldwin and Woodard 2008). The degree of modularization should fit the platform's

governance in order to achieve agility outcomes (Tiwana et al. 2010). Further work has emphasized the (standardized) *design of interfaces* (Ghazawneh and Henfridsson 2013). Especially in terms of digital innovation, it is proposed that modularity is essentially changing the business architecture (Venkatraman and Pavlou 2014; Yoo 2013). Gawer and Cusumano (2014) recommend as an effective practice for platform leadership to evolve and *innovate* the platform core in order to improve the ecosystem's vibrancy, which resembles the '*resourcing*' strategy proposed by Ghazawneh and Henfridsson (2011).

### ***Supporting Literature for Business Capabilities in Platform Ecosystems***

We refer to business capabilities for all capabilities that are independent from the technological core of the cloud platform (the IT artifact). Given the scarcity of prior literature on business capabilities in (cloud) platform ecosystems, we draw on multiple related studies that have touched up on specific business aspects relevant to value creation and appropriation on platforms: First, within the platform ecosystem literature there is a broad agreement that platform governance capabilities are essential. This includes decisions on pricing model incentives, i.e. which sides to charge (symmetric: charge both sides; asymmetric: charge only one side) and how to charge (based on access or usage etc.) (Evans 2013; Tiwana 2014). Further, non-pricing rules have to be defined considering access (who is allowed to join) and interactions (what are the various sides allowed to do) (Boudreau and Hagiu 2008; Hagiu 2014). Finally, the degree of platform openness is another important consideration enabling complementors to participate within the ecosystem to develop or commercialize via the platform (Boudreau 2010; Eisenmann et al. 2009). Granting access to independent providers may enable the emergence of complementary component markets around the platform (Boudreau 2010). Decisions about the desired level of quality control for the platform ecosystem and the mode of competition between platform services and complements ('exclusivity') have to be made (see e.g. Eisenmann et al. 2009; Wareham et al. 2014). Furthermore, common *marketing activities*, strategies for building a partner ecosystem and developing a 'collective identity' as well as altered sales strategies (incl. compensation) are acknowledged as necessary means to establish platform leadership (Gawer and Cusumano 2014; Jansen et al. 2012). Moreover, platform providers often support complementors in various activities and stages, such as the *development of sales and support* activities (see e.g. Gawer and Cusumano 2014; Jansen et al. 2012). Information exchange and feedback processes between participants are thought to be advantageous to quickly adapt and adjust to market and partner needs (Venkatraman and Pavlou 2014).

### **Methodology**

We employ an explorative multiple case study approach in the spirit of Eisenhardt and Graebner (2014) in order to study the phenomenon of interest (i.e., capabilities for value creation and appropriation) at the unit of analysis (i.e., cloud platforms) in a real-life context. Collecting and analyzing qualitative data through a case study offers deep insights into the complex social processes of cloud platforms that quantitative data cannot easily reveal (Yin 2009). As IT capabilities have only been broadly characterized by prior business model literature, and business capabilities have remained undertheorized, we regard our exploratory approach as particularly useful to discover relevant sub-categories and other unanticipated features relevant to this phenomenon.

### ***Data Collection***

The cases for this study were selected based on a diversified sampling strategy (Seawright and Gerring 2008) in that we selected cases that represented different strategic intents, as conceptualized by Rai and Tang (2014) as (1) developing market and customer, (2) developing innovative products/services, (3) generating complementarities, and (4) increasing market responsiveness. We hereby intended to ensure a good heterogeneity of different IT-enabled business models in the sample. According to Seawright and Gerring (2008) a heterogeneous sampling can result in higher representativeness of cross-case results. We utilized reports from several market research institutes (e.g., Gartner, IDC, Forrester, Experton) on different cloud platform market segments (e.g., application-PaaS (aPaaS), integration-PaaS (iPaaS), cloud application platform) to identify case candidates. From this, only market leading cloud platforms were selected to ensure comparability with respect to market performance. Table 1 describes the four anonymous providers participating in this study with regards to company details and overall offerings of their cloud platforms.

**Table 1. Case Overview**

<b>Case label</b>	<b>Strategic intents (Rai and Tang 2014)</b>	<b>Case description</b>
Alpha	Develop market and customer relationships	Alpha is a medium-sized software company consisting of a association of SaaS vendors and consultants in Germany. Alpha's focus is on development of community cloud platforms and advisory for cloud marketplaces. Alpha leverages an existing ecosystem of vendors (the association) and provides a marketplace-oriented cloud platform for IT procurement. This platform further offers value-added services (e.g., identity management, billing API). The marketplace develops new markets for their complementors and focusses on comparability, trust and quality aspects of their offerings. (Total number of employees > 25)
Beta	Develop innovative products/ services	Beta is a US-based global corporation operating in the enterprise and consumer software markets. Beta is a leader in several of these market segments. It was one of the first companies offering ASP and SaaS services and it is experienced in building and managing data centers. Beta's platform incorporates Infrastructure as a Service (IaaS) and PaaS as well as special services used by complementors. Beta's portfolio is being transformed continually and more platform services are added. Beta aims to support its customers in developing innovative solutions. (Total number of employees > 100.000)
Gamma	Generate Complementarities	Gamma is a US-based global corporation operating in the enterprise software and consulting service markets. Gamma is recognized for its technological R&D capabilities and the company provides a mix of software and hardware products for enterprises. Gamma's platform solutions are complemented by a SaaS marketplace that addresses developers and customers alike. This platform focusses on software development and further services (e.g., analytics, mobile) based on reusable complements for both own developers and third party complementors. (Total number of employees > 200.000)
Delta	Increase market responsiveness	Delta is a US-based global corporation operating in the enterprise software and services market. Delta is a market leader in several of these segments where the company relies heavily its established on-premise software products. Market researchers acknowledge that Delta's platform is gradually catching up and building a competitive position. Delta aims to transform its products into cloud services by offering an application development platform (IaaS and PaaS) to leverage its own portfolio. Regularly new services are announced (e.g., for Internet of things or analytics applications). By offering integrated and highly flexible platform, Delta aims to increase market responsiveness of their partners. (Total number of employees > 100.000)

We conducted interviews as a means to access the internal organizational specifics and thoughts of the participants (Myers and Newman 2007). We relied on a semi-structured interview guide with open-ended questions in order to make sure relevant aspects are covered, where we also gave interviewees the possibility to add aspects of their particular interests. The interview guide was structured into three main sections asking for different aspects: (1) introduction (role, experience, common agreement on terms), (2) value creation and appropriation, and (3) key capabilities and resources. We chose suitable interviewees in consideration of the guidelines by Sarker and Sarker (2009). In particular, we considered their necessary experience and knowledge and sought for appropriate roles at the case organizations, such as product managers, partner managers, or architects.

Furthermore, we triangulated data by including 'various' voices within a case (Myers and Newman 2007) and preferring interviewees with different roles (i.e., technical and business roles). We followed the advice of Myers and Newman (2007) by sharing a summary of the research project's objectives and interview guide upfront to ensure a common understanding of the content and goals of the interview. Anonymity and confidentiality was guaranteed. As an incentive for participation general results and individual feedback were offered. Furthermore, we asked interviewees for a referral to platform complementors in order to gain an outside perspective. Due to accessibility, we were able to interview executives of complementors in two of the four cases.

In addition to interview data, we considered other documents and information, both publicly available and internal information received from interviewees. In particular, we looked into company presentations, brochures, FAQs, videos, and accessed the platform itself where possible. The interviews were scheduled between August 2015 and February 2016; three of them have been conducted face-to-face and seven via phone. Interviews were held in German language, which was the mother tongue of all participants. Each conversation was digitally recorded and subsequently transcribed by native speakers

who were familiar with the subject matter and terminology. In total, 561 minutes were recorded and the transcribed material amounted to 60,266 words. Table 2 describes the interview details for each case.

Table 2. Profiles of the Interviewees and Interview Details						
Case #	Interviewee role	Company Role in Ecosystem	Size	Date	Duration / Transcription size	Additional material (quantities)
<b>Alpha (A)</b>	C-Level (CMO) (A#1)	Platform Owner	SME	08/2015	55 min. / 6,102 words	Internal Meeting Minutes (10), Brochures (1), Official Presentations (4)
	C-Level (CEO) (A#2)	Platform Owner	SME	09/2015	59 min. / 5,132 words	
<b>Beta (B)</b>	Partner Business Developer (B#1)	Platform Owner	Corp.	08/2015	48 min / 4,335 words	Customer Success Reports (5), Website (1), Platform Information & FAQ (4)
	Senior Technical Consultant (B#2)	Platform Owner	Corp.	09/2015	55 min / 5,705 words	
	CEO (B#P3)	Complementor	SME	02/2016	61 min / 7,936 words	
<b>Gamma (G)</b>	Platform Product Manager (G#1)	Platform Owner	Corp.	09/2015	55 min / 5,376 words	Customer Success Reports (2), Website (1), Platform Information & FAQ (6), News Reports (3)
	Sales Manager Europe (G#2)	Platform Owner	Corp.	10/2015	41 min / 3,630 words	
<b>Delta (D)</b>	Sales Manager Europe (D#1)	Platform Owner	Corp.	09/2015	62 min / 6,210 words	Customer Success Reports (4), Website (2), Platform Information & FAQ (6), News Reports (4)
	Senior Technical Consultant (D#2)	Platform Owner	Corp.	10/2015	79 min / 6,552 words	
	CTO (D #P3)	Complementor	SME	02/2016	46 min / 6,288 words	

## Data Analysis

Overall, we were led by the methodological guidelines by Sarker and Sarker (2009) and Dubé and Paré (2003) to ensure rigorous data analysis and representation. In terms of data analysis, we applied coding as a tool to support data complexity reduction. We relied on a priori codes based on the pre-conceptualized framework by (Rai and Tang 2014) and combined this with open coding, where we assigned codes to data chunks. Then, we grouped these concepts into categories utilizing our a priori categories where possible. For example, the capability of standardizing a SaaS transaction (incl. contract closing and billing) process was coded as 'Network IT Capability: Process Standardization'. Once we created this hierarchical structure of codes, we followed with the second step by analyzing the relationship between the (sub-) categories (e.g., between business capabilities and value creation). Finally, we applied selective coding, by dismissing codes which were not in the focus of the central phenomenon (i.e., capabilities for value creation and appropriation). For example, we dismissed aspects of different data privacy regulations and laws from the analysis. Coding was performed by one of the researchers using qualitative research software tool ATLAS.ti 7 and resulting codes were discussed with two other researchers in an iterative fashion until common agreement was reached.

To understand the role and impact of business capabilities on value creation and appropriation, we took a configurational view for the cross-case comparison (e.g., Henfridsson and Bygstad 2013). Configuration theories help to better understand interconnected dynamics in digital phenomena (El Sawy et al. 2010). They seek to understand how specific combinations of causal variables (termed elements or conditions)—summarized as a configuration—generate an outcome of interest (Meyer et al. 1993; Rihoux and Ragin 2009). Configuration theories consider phenomena as clusters of interconnected elements which need to be understood simultaneously. Based on the identified capabilities, we examined which capabilities are required for each value creation and appropriation mechanism and how they differ across the cases. For each value creation or appropriation mechanism, we considered only those of the four cases that exhibited a specific value creation or appropriation outcome (e.g., Delta does not employ the value creation mechanism of novelty, therefore we did not consider Delta for explaining novelty outcomes). We then compared these cases looking for commonalities and differences in the explaining concepts, thus detecting configurations yielding the same outcome but employing different capabilities resulting in four configurations (two for value creation, two for value appropriation). The identified configurations of this



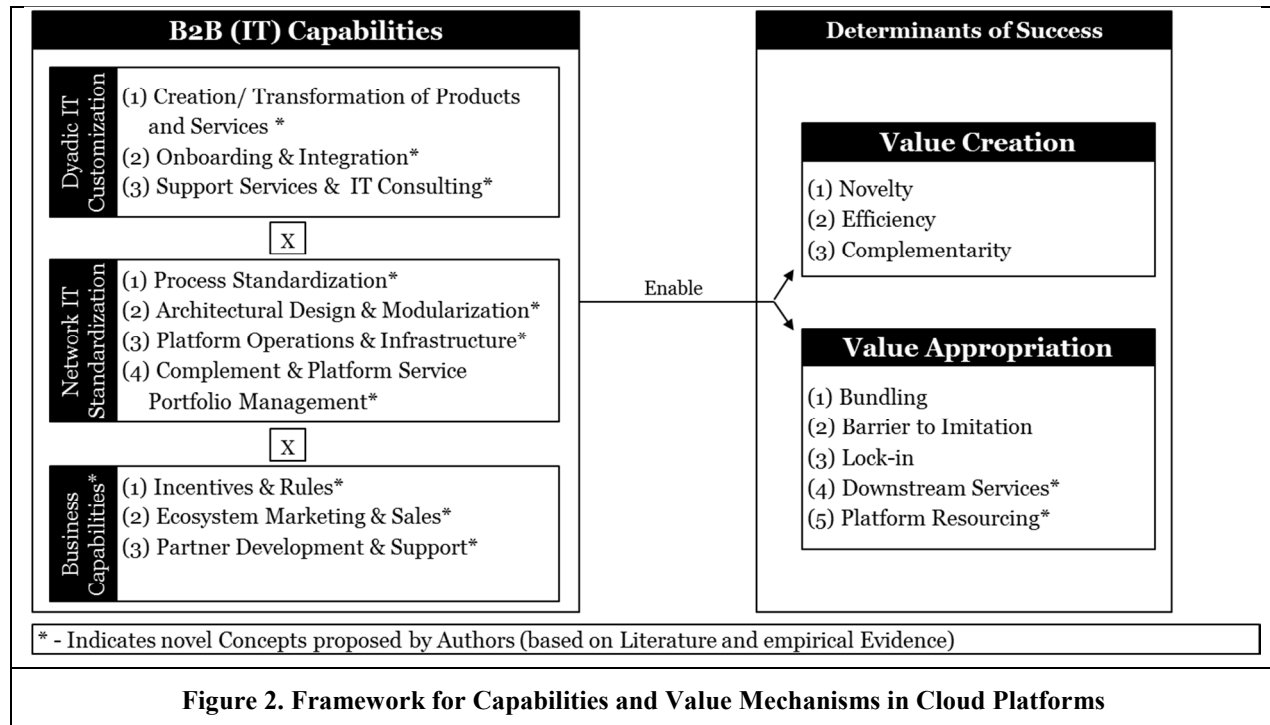
exploratory research, which we do not claim are exhaustive, were then summarized in a set of propositions presented in the next section.

## Results and Discussion

### Framework for Cloud Platform Capabilities and Value Mechanisms

Figure 2 depicts the proposed framework of capabilities and value creation and appropriation mechanisms for cloud platform ecosystems, with novel concepts highlighted. Due to space constraints, we only briefly introduce each concept in the following, but provide the concept definitions and exemplary empirical evidence in Table 3.

For *dyadic IT customization capabilities* we identified three sub-categories. First, the capability ‘creation/ transformation of products and services’ into platform services or complements aims at increasing its functionality and scope (own portfolio or third party). For example, if the platform owner has a database as a product, it needs to be transformed into a platform service. All cases in our study had IT products before, which solved a range of these problems but needed to be transformed and integrated under the umbrella of the platform, referring to the ‘coring’ strategy and facilitation of external complements mentioned by prior literature (Gawer and Cusumano 2014, 2008). Second, ‘onboarding & integration’ describes the capability of bringing complements (e.g., add-ons or third party platform services) on the platform. This includes quality assurance (code reviews etc.) and connecting to the interfaces of the platform (see e.g. Axelsson and Skoglund 2015). Third, ‘support services and IT consulting’ refers to a sub-capability of the platform provider of getting individual partners used to the platform and receiving individual support. This would be the case, for example, when a support agent in a call center is available to help a customer with the technology or when an on-site specialist walks a developer through the possibilities and specifics of the platform (Hilkert et al. 2011; Jansen et al. 2012).



Four concrete *network IT standardization capabilities* emerged from the analysis. First, *process standardization* includes the definition of information and activity flows, its information requirements and exchange formats executed through (pre-) integration across different applications. We further found that the level of processes that are standardized between platform providers and complementors range from the application development processes, and transaction and procurement processes up to whole

enterprise business processes (e.g., by connecting sales and production processes and systems) (cp. Jansen et al. 2012; Markus and Loebbecke 2013; Muylle and Basu 2008). Second, *'architectural design & modularization'* refers to the capabilities of a platform owner to design the (standardized) interfaces to be utilized by complementors and increase flexibility by adapting the platform to changing environments and requirements (cp. Baldwin and Woodard 2008; Tiwana et al. 2010). In all cases, we found that interfaces were designed according to open standards (e.g., REST APIs) and documentation was made publicly available. Specific to application development processes, standardization frameworks (e.g., Cloud Foundry or OpenShift) or container technologies (e.g., Docker) may play a crucial role for transferring applications within different environments. Third, *'platform & infrastructure operations'* refers to the ability to operate the platform itself in a secure manner and complying with IT security and data privacy regulations. This also includes the ability to offer infrastructure services for complements. Furthermore, deployment models for platforms (and their services) ranges from purely public to private models and hybridization approaches (see also e.g. Cusumano 2010a; Yang and Tate 2012). Fourth, *'complement & platform service portfolio management'* comprises capabilities of lifecycle and portfolio analysis for platform services and complements within the ecosystem. It further comprises the strategy definition of which services are required (innovation) and also analyzing feedback on existing or desired services from the ecosystem participants. Furthermore, this involves the balancing act of quality versus quantity of complements (broadest portfolio or best in class portfolio) (Gawer and Cusumano 2014; Ghazawneh and Henfridsson 2011).

In addition to instantiating the categories of IT capabilities, evidence for the importance of *business capabilities* emerged, which we conceptualized into three sub-categories: First, *'incentives & rules'* refers to the capability of being able to establish common rules for ecosystem participation and utilization of the platform. This includes deciding on the openness of the platform with regards to general participation including exclusivity (Eisenmann et al. 2009; Wareham et al. 2014). For example, Gamma allows complements to compete with its platform services whereas Delta does not. Further, Gamma and Beta want to stimulate complement generation by e.g. stipulating mandatory offerings of test-periods or free-of-charge thresholds. Second, we propose *'marketing & sales'* as another important sub-capability. This category comprises all required capabilities to market the platform itself, but also to increase market readiness by evangelizing the advantages of the cloud platform approach in general. All interviewees emphasized the need to establish trust and create or maintain a trusted brand. The cases also highlight common marketing activities, such as publishing customer success stories on the website and joint appearances at industry fairs creating marketing synergies (cp. e.g. Jansen et al. 2012). Marketing & sales capabilities further comprise building a partner ecosystem. In two cases, interviewees particularly stressed the necessary change in sales from selling products to selling services and future opportunities. We found that sales incentives and compensations need to be managed, as mentioned by prior literature (Gawer and Cusumano 2014; Jansen et al. 2012). Third, we found that *'partner development & support'* capabilities play an important role for cloud platforms. Partner development comprises all activities and structures in order to support complementors in the creation and sales of complements, such as business development, market(ing) strategy and business model development (see also Gawer and Cusumano 2014; Jansen et al. 2012). Gamma, for example, offers on-site workshops advising on the complete ideation process of an application (i.e., design thinking from idea generation to idea testing and validation). Furthermore, this sub-category includes the capability of gathering partner feedback on the platform and its services as well as missing services and opportunities (Venkatraman and Pavlou 2014).

The three *value creation* mechanisms have interesting specifics in the context of Cloud platform ecosystems: First, *'novelty'* was evident by novel sales channels through electronic marketplaces or platform service catalogues in three of the four cases. In particular, we found altered transactions structures where the end customer access will be provided via sales multipliers (Alpha). Furthermore, we observed the possibility to monetize software through offering complementary platform services to other developers or offering SaaS service towards end-customers (Beta, Gamma). Creation of *efficiency* was found by the provision of a standardized application development and operations platform. This lowers the necessary tasks of managing the development and operations infrastructure for developers and let complementors focus on their core competencies. Furthermore, the standardization and execution of transactions within the IT-procurement processes achieves efficiency. Finally, through pre-integration of enterprise information systems available on a platform, these standardized business enterprise processes also create efficiency. Third, value creation through *'complementarity'* in cloud platform ecosystems is

achieved through the development of innovative services which are supported or enabled by platform services. We further found the notion of creating innovative applications through assembling ‘building blocks’ (platform services) which resembles the concept of ‘combinatorial innovation’ and ‘mash-ups’ (Yoo et al. 2012).

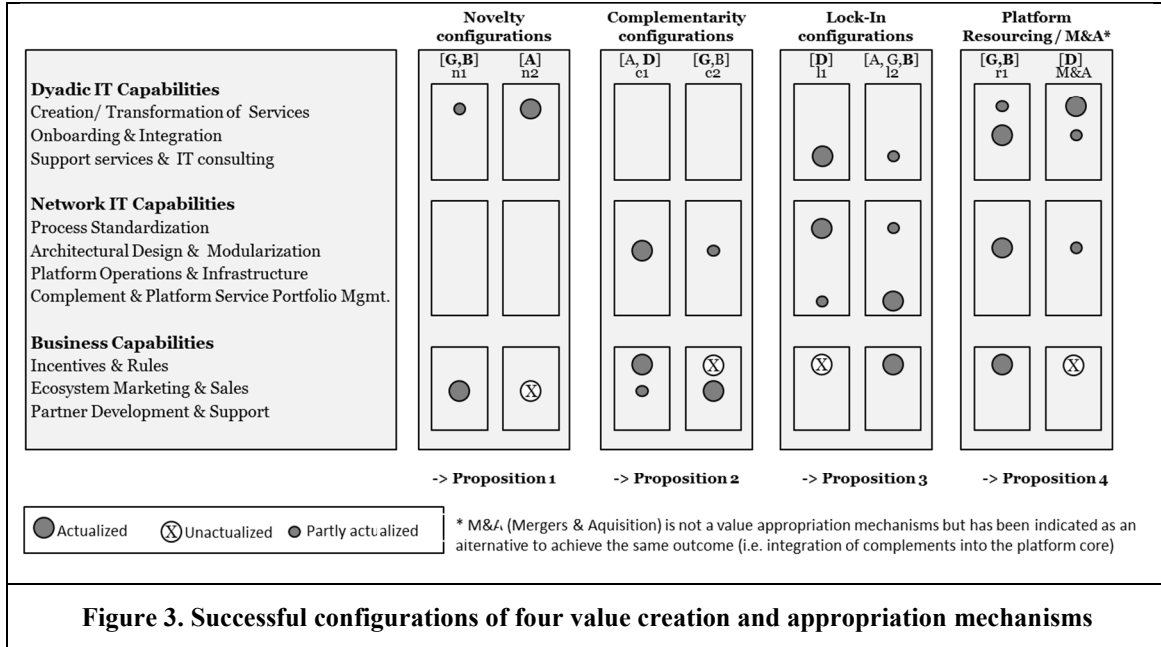
In addition to the evidence for the three *value appropriation* mechanisms emphasized by prior literature (Teece 2010), two additional mechanisms relevant to cloud platform ecosystems emerged from our analysis: First, the most prominent appropriation mechanism in cloud platforms is the ‘*bundling*’ of (basic) platform services. For example, the application development services (programming environment) including database services, infrastructure and additional support services are bundled. This bundle often also comprises business activities (such as marketing and partner management). The pricing mechanism is then based on the infrastructure that is consumed to cover the basic services. Second, we found that ‘*lock-in*’ occurs to a certain extent through technological (proprietary or specific service APIs) and organizational (process integration) structures. By supporting industry standards (e.g., Docker, Cloud Foundry), some case organizations want to prevent technological lock-in and instead persuade complementors by offering superiors services. Third, we found that ‘*barrier to imitation*’ only plays a minor role in value appropriation since intellectual property (IP) of software is hard to protect. Only few specific platform services with high knowledge (such as specific cognitive services) are considered as IP protected property. Fourth, as an extension to the model of Rai and Tang (2014) we propose ‘*downstream services*’ as a complementary mechanism for appropriating value. Among our cases we found, for example, that software consulting services for implementation or data migration were offered. These are billed separately and help platform providers lower the entry barriers for complementors, which is why they fit into a value co-creation oriented strategy (see, e.g., Huang et al. 2012; Huntgeburth et al. 2015). Fifth, we propose the notion of ‘*platform resourcing*’ as another important capability in a cloud platform context. Resourcing refers to arrangements where complements appear to potential customers as integral parts of the platform, while they are still managed autonomously by the complementor. The platform provider ensures quality and integration of the complement, thereby appearing as a platform service. These complements can be reused by other complementors and therefore extend the core platform service and increase its perceived value for other developers or customers.

**Table 3. Description of Concepts with Empirical Evidence (\* indicates concepts that emerged from our analysis)**

		Description	Exemplary Empirical Evidence
Dyadic IT customiza	Create/Trans-form Services*	Creation/ Transformation of Products and Services' into platform services or complements to increase functionality (own portfolio or third party).	„One of our biggest advantages is the large portfolio we had already. We transformed them into services [...] as separate modules” (B#1)
	Onboarding & Integration*	Mechanism of bringing complements (e.g. add-ons) on the platform including quality assurance and connecting them to interfaces.	„We [product managers] control the developer services catalogue [...], decide according a list of quality measures[...] as we only want high quality” (G#1)
	Support services & IT consulting*	Capabilities of the platform provider of getting used to the platform (e.g. technical standards) and receiving (individual) support to familiarize.	“We have a customer success manager organization that consults customer after sales for free [...] showing how to set up e.g. a database.” (D#1)
Network IT standardization	Process Standardization*	Definition of information and activity flows and exchange formats supported by their (pre-) integration ranging from application development, transaction processes to whole enterprise processes.	„It is our goal that all these applications [Delta´s SaaS] are available on the platform and can be integrated [...] via open standards [or we] pre-integrate everything for private and public Cloud.” (D#1)
	Architectural Design & Modularization*	Capabilities of platform owner to holistically design architecture and interfaces utilized by complementors and increase flexibility (adapting to changing environments and needs).	“Technical [integration] is not that difficult given the software is written modularized [...] It is possible to integrate services from our catalogue whose code can be pushed onto the platform easily via [a PaaS standard].” (G#2)
	Platform Operations & Infrastructure*	Ability to operate the platform itself in a secure manner and complying with IT security and data privacy regulations. This includes the ability to offer infrastructure services for complements.	For PaaS solutions it is of utmost importance to be highly available [with] fully automated infrastructure [...], capabilities of managing data centers [...] on high security level (certified, audited), appropriate mgmt. processes” (B#1)
	Complement & Platform Service Portfolio Mgmt.*	Portfolio analysis of platform services and complements, strategy definition of which services are required (innovation), gathering feedback on services (absorbing market knowledge).	“[Our goal is] to offer the largest catalogue possible[...] to give the customer the choice. Consider the AppStore example, you need to give the customer the chance to find and decide which solution is best for him” (A#2)
Business Capabilities*	Incentives & Rules*	Establishing rules for ecosystem participation and utilization of the platform (incl. openness, mandatory offerings of test-periods or thresholds, participation rules for standardization and exclusivity)	„These services are not only complementary solutions but in direct competition with our own [...] services are billed 'pay-as-you-go' which is important for experimenting and sort of risk sharing.” (G#1)
	Ecosystem Marketing & Sales*	Market platform and increase market readiness, establish trust (brand) and marketing synergies (e.g. joint appearances at industry fairs), build a (partner) ecosystem, appropriate sales approach (incl. compensations).	„You need to establish synergies in marketing “ (A#2); „Quality [...] our products and acquired services are best-practice and market leaders which is recognized on the market” (D#1)
	Partner Development & Support*	Support complementors in the creation and sales of complements, such as market strategy and business model development. Absorbing market knowledge and needs from complementors.	“The central task of my role is to make partner solutions successful [...], some colleagues even only specialize in go-to-market activities and build a sustainable business model” (B#1)
Value Creation	Novelty	Additional sales channels through marketplaces either directly or via sales multipliers. Monetizing software by offering platform services to developers or offering SaaS to end-customers.	“We as a sales channel take over a part of our partner´s job” (A#2); “If these solutions meet the quality criteria they can be listed [in the marketplace] thus offering a new sales channel” (B#1)
	Efficiency	Through standardization of processes (pre-integrated) & taking over tasks from developers (operations) to let them focus on core competencies.	„There is the elasticity, flexibility, and scalability of resources [...] meaning that a developer does not need to care about high availability” (B#2)
	Complementarity	Development of innovations & add-ons supported or enabled by platform services (e.g. developer environment and reusable services).	“All our services can be accesses via very similar RESTful API[...] it is very easy to integrate these as building blocks” (G#1)
Value Appropriation	Bundling	Bundle of technical platform services (e.g. database) and often business activities (partner mgmt.) & pricing based on consumed infrastructure.	„The more this partner service is used, the more resources are consumed [...] we participate in the success[...] based on consumed resources” (B#2)
	Lock-In	Increased switching costs through technological (proprietary service APIs, process integration) or organizational lock-in (superior platform services).	“There is certainly a lock-in and most partners that develop are knowingly calculating with the risk [...] vs. reward of using building blocks.” (B#1)
	Barrier to Imitation	Only few specific platform services with high knowledge are considered as IP protected property but not the whole platform.	“There is intellectual property behind specific services, I often use the cognitive services as an example which we only offer currently.” (G#1)
	Downstream Services*	Separately billable professional services (e.g. IT consulting) to help utilizing the platform or building complements.	“Of course we can offer billable consulting for integration services if the customer is asking for that.” (D#1)
	Platform Resourcing*	Complements are becoming part of platform but still maintain autonomy over solutions. Platform owner ensures quality and integration thereby appearing as a platform service and can be reused by other complementors.	“We asked an existing partner [...] to offer his existing SaaS solution for end-customers encapsulated with an API for developers” (G#1); “This service can now be used as SaaS or utilized within other complements” (G#2)

## Successful Configurations of Selected Value Mechanisms

Based on the derived framework of capabilities, we identified pairs of configurations for two value creation (novelty, complementarity) and two value appropriation mechanisms (lock-in, platform resourcing) that yielded the same outcome, but employed different IT and business capabilities. Figure 3 shows these pairs of successful configurations, each of which we will explain in the following jointly with empirical evidence and a discussion of related literature and theory.



## Marketing and sales capabilities for value creation through novelty

Our analysis found that in the creation of novel sales channels (*novelty*), two successful configurations differed with respect to the *creation/ transformation of platform services or complements* (dyadic IT capabilities) and *marketing and sales capabilities* (business capabilities). We observed that along with their large ecosystem sizes, Beta and Gamma had required capabilities for marketing and sales (and established market connections), therefore they do not need to increase dyadic IT effort for establishing new sales channels:

*„We already have a very large ecosystem which we utilize and offer to establish access to our key accounts. [...] [These solutions] will be marketed via our existing channels of course.“ (B#1)*

*“They recognize it as a global sales channel [...], most are already within our ecosystem and understand what it means [...]. They understand our platform and know if they offer their service here, tomorrow 500,000 developers can see and use my services.“ (G#1)*

In contrast, the medium-sized platform provider Alpha is not capable of developing the second market-side (B2B software customers) due to missing resources, know-how, and existing relationships. To compensate for this weakness, Alpha has developed a ‘sales multiplier’ approach in which selected large sales partners were approached that already had larger access to B2B customers (especially to SMEs), but lacked the cloud services platform to sell. For example, large office suppliers (that traditionally do not sell software) were approached to sell SaaS to their existing customer base. Alpha then customizes their platform (platform design and application portfolio) to each multiplier thereby driving dyadic IT efforts with these selected partners (*creation/ transformation of services*) and gets a revenue share in return for each service sold via the platform.

*„We are not strong in end-customer access [...] we approach multipliers offering our catalogue and platform which enables them to leverage existing end-customers with a fast time-to-market.“ (A#2)*

*“we can build ‘sub-stores’ individualizing their look and feel [...] addressing specific functions such as healthcare or logistics up to the point where specific vertical services are added” (A#1)*

We summarize our finding on both successful configurations by the following proposition:

**Proposition 1:** The creation of novel sales channels in cloud platform ecosystem requires either marketing and sales capabilities, or, in case of absence of the such capabilities, additional sales partner structures, which increase the dyadic IT customization effort.

This proposition can be related to prior arguments in the platform literature: Tee and Gawer (2009) find that industry architecture, including variables such as a firm’s scope, bargaining power, capabilities, and relationships with other firms, impacts the success of a platform. They further argue that architectures can be manipulated by deliberate firms which can be interpreted as managerial actions from the platform leadership strand (Tee and Gawer 2009). In the field of market intermediaries Zhao et al. (2009) also highlighted the importance of prior market structures in determining the success of B2B e-marketplaces since they only need to connect to a reduced number of buyers or sellers. Employing this reasoning to our two configurations, we suggest that Alpha is trying to overcome deficits (i.e., missing marketing & sales capabilities; end-customer relationships) from an industrial architecture perspective, by adding further multipliers into the transaction structure thereby driving dyadic IT customization effort.

### **Incentives & rule capabilities for value creation through complementarity**

The platforms of Gamma and Beta follow the philosophy that complementors should be able to develop any type of complementary products through recombination of building blocks, which can be the platform’s own services or other complements. These two platforms providers do not guarantee exclusivity rights for complements, but rather want to encourage complementors to compete with their own platform services. They further want to establish self-reinforcing mechanisms by lowering the barriers to test other services and complements. Both platform providers stipulate that complements offer free test periods or usage thresholds to stimulate the generation of further complements utilizing other complements. This requires strong capabilities in terms of modularity through a loosely coupled architecture (*architectural design and modularization*), for which Gamma, for example, utilizes a standardized and open PaaS framework.

*„These services are not only complementary solutions but also services in direct competition with our own from third party providers [...] All our services can be accesses via very similar RESTful API which is part of our value add since it is very easy to integrate these as building blocks in a similar way for developers” (G#1)*

*“It is one of our strategic intents to be the platform where cool and innovative ideas are implemented. [...] We stipulate that all of these services have a free tier since we want user to experiment with them [...] which is a pay-as-you-go model where you pay based on your success.” (G#2)*

In contrast, we did not find strong incentives and rules for complementarity creation in the case of Delta. Instead, Delta is approaching the generation of complements through increased sales margins and rebate programs for partners that utilize Delta’s platform. The provider thereby is stimulating complementor participation by focusing on increased earning potential through platform utilization, but neglects earning potential of superior complements. In that, Delta also avoids complements competing to the platform’s own services.

*„We are currently running an incentive program which consists of an initial training where ISVs commit for a certain time for a competition and where we have special increased incentives which are higher than on-premise by factor of 3 [...]. We have a customer success manager organization that consults the customer after sales for free. “ (D#1)*

Hence we posit **Proposition 2:** The creation of complementary applications in cloud platform ecosystem requires either incentivitation and rules with strong architectural design capabilities, or, in case of absence of incentives and rules, strong marketing and sales capabilities can offset these.

This proposition shows some parallels to prior literature. Yoo et al. (2012) concluded that recombination of digital artifacts (‘mash-ups’) through standard interfaces enables generativity with nearly limitless possibilities (e.g., Lessig 2008) and is enabled by modularity (Yoo 2013). In the context of digital

infrastructures, Henfridsson and Bygstad (2013) identified three generative mechanisms: (1) innovation (creation of new products and services), (2) adoption (more invested resources increase usefulness and user adoption), and (3) scaling (increased reach by attracting new partners through collaboration incentives). Applied to our context, we found that Delta is not focusing on generative innovation through complementarities (opposed to Beta and Gamma). Still, Delta is employing the scaling mechanism through sales margins. Gamma and Beta adopt the scaling mechanism by offering revenue-share models and low entry/ testing barriers and have increased efforts in terms of standardization and modularity to enable the generative innovation mechanism. Our finding thus shows parallels to the two configurations proposed by Henfridsson and Bygstad (2013), who found that either innovation, adoption and scaling (Gamma & Beta) or only adoption and scaling (Delta) are successful. Further, Boudreau (2010) concludes that incentives for innovations are affected by the degree of openness.

### Process standardization capabilities for value appropriation through lock-in

We observed that lock-in can be achieved through two different configurations. Delta wants to achieve lock-in through the pre-integration of their services and applications in order to *standardize business processes*. Furthermore, they integrate operational administration functions that enable the switch between private and public mode of operation, thereby enabling hybrid platform ecosystem. This pre-integration effort requires dyadic transformation of their products and platform services once and is accompanied by *technical support consultants* that facilitate familiarity with the technology. This strategy only works in a rather closed portfolio of applications and platform services due to the effort required for integration. The sales approach emphasizes a focus on cross-selling and upselling (i.e., expanding the installed base) by further platform services and applications, where the customer does not need to be concerned about integration into its own IT landscape.

*„It is our goal that all these applications [Delta’s SaaS] are available on the platform and can be integrated [...] via open standards. We want to increase our application business via platform and its integration and vice versa. We look how many of our customers bought more than one module, these probably need integration. This is the strategy behind; lock-in is a strong driver.” (D#1)*

In contrast, Gamma and Beta aim to achieve lock-in by offering the best application and platform services which are managed via the *service portfolio management* (network IT capability) and *created or transformed via dyadic IT capabilities*. That is, constant ecosystem feedback and market observation help to identify the required services that need to be implemented. Through *incentivation and rule definition* towards competing platform complements, the competition towards best services is stimulated and incentivized to further improve its own and third party platform services.

*„The market demands openness [...]. The decisive factor is innovation speed, you need to be the first to offer certain services in order to create a value-add for our partners. This is not proprietary technology lock-in but adopting or offering services that the market needs.” (B#2)*

*„There is certainly a lock-in and most partners that develop are knowingly calculating with the risk [...] versus reward of utilizing special services in their service (e.g., sophisticated machine learning services) which would take a lot of effort in self-implementation.” (B#1)*

We derive **Proposition 3**: The value appropriation through lock-in in cloud platform ecosystem can be either be achieved through high process standardization and partly proprietary technology based on a rather closed ecosystem, or alternatively through superior portfolio management that identifies and eventually creates innovative platform services.

In the literature on platform business models, it is widely acknowledged that the relationship between openness and lock-in has to be balanced across participants (Ballon and Van Heesvelde 2011). This further implies tradeoffs between platform adoption and its ability to appropriate value while more openness leads to reduced concerns about lock-in and increased stimulation (West 2003). Platform owners will prefer mostly proprietary governance models (due to superior rents), unless they face pressure or expect increased profits by selling complements via the platform (Eisenmann et al. 2009; West 2003). Thus, we argue that Delta is creating lock-in effects by commoditizing business processes (cf. Markus and Loebbecke 2013) through pre-integration and enabling hybrid infrastructures on proprietary technology. Although all interfaces are open and standardized, they are creating switching costs through integration by the platform. In contrast, Beta and Gamma are creating lock-in effects through superior

reusable platform services. We are interpreting this under the umbrella of the ‘recombinability’ characteristic of digital innovation (Yoo et al. 2012). From the perspective of a complementor, this generates dependencies on certain platform services thereby improving the bargaining power of a platform provider who controls these services (‘bottleneck’). This is in line with Boudreau (2010), who proposes that if a platform owner has sufficient bargaining power, the provider is able to lock-in customers and complementors without exercising control over the entire ecosystem.

### **Incentive & rule capabilities for value appropriation through platform resourcing / M&A**

We observed platform resourcing in the cases of Beta and Gamma which can be described as a self-reinforcing process in which the platform expands its reach and scope as it attracts new complementors by creating incentives for collaboration and integrating their complements into the platform’s own service portfolio. The self-reinforcing mechanisms are comprised around revenue-sharing, low-entry barriers and increased sales channels and volume. This generativity mechanism (scaling) requires the incentivization and rule capabilities in order to enable and create these self-reinforcing mechanisms. The platform owner has to ensure the quality and reliability of the complements (*onboarding*). Furthermore, these complements must strongly comply with the *modularization and architectural* guidelines to utilize all required functionalities (e.g., billing).

*„We asked an existing partner [...] to offer an existing SaaS solution for end-customers encapsulated with an API for developers [...]. This works quite similar to an AppStore where we sell the service, host the service and bill [...] Technical [integration] is not that difficult given the software is written modularized [...] This is nothing compared to the effort required for quality assurance, discussing legal agreements etc.” (G#1)*

In contrast, at Delta as a platform provider decides not to open the platform (core) towards third party complements. Delta stated that interesting complements would be rather acquired and integrated into the platform, thereby increasing the *platform service transformation* effort (dyadic IT capabilities). Our interviewees further stated that openness in this case would be contradicting the efficiency strategy customer value is created through process standardization and integration.

*„We would rather acquire it [...]. Our philosophy is that we buy best of breed and integrate it into our platform thereby creating value. Otherwise it would be contrary to our strategy, if each customer has to pay for integration.” (D#1)*

We therefore derive **Proposition 4:** Value appropriation through platform resourcing is enabled by the capabilities to incentivize and defined rules for platform complements with increased effort of onboarding and modularization. Alternatively, the complement can be acquired by the platform owner and needs to be transformed into a platform service.

This configurational proposition can be better understood by drawing on the concepts of platform ‘coring’ and ‘tipping’ (Gawer and Cusumano 2008). Coring aims at utilizing a platform’s own resources to innovation through acquisition of external complements to extend core functionality (Toppenberg et al. 2016). Tipping can be accomplished through the mechanism of platform envelopment that is described as absorbing technical features from adjacent markets which then extend the platform core (Gawer and Cusumano 2008; Tiwana et al. 2010). Applied to our two configurations, we propose that Delta’s strategy towards platform innovation is self-organized innovation or through acquisition in order to retain full control over their platform. This is of importance as their efficiency value creation focus demands for pre-integration and partly proprietary technology (compare, e.g., Toppenberg et al. 2016). We can view the mechanism of platform resourcing (Gamma, Beta) as an intermediary approach to coring since complements are selected and (partly) controlled as part of the extended platform core. This can also be understood as the generative scaling mechanism described by Henfridsson and Bygstad (2013) where modularity is of utmost importance. In this way, innovative complements become available for other complementors while at the same time the advantages of core platform services (such as quality, availability, service terms etc.) can be enjoyed. Hence, we infer that value appropriation through platform resourcing and innovation are influenced by the capabilities to incentivize and define rules for ecosystem participation.



## Conclusion, Limitations and Future Research

Motivated by the need for a deeper understanding of the conditions of cloud platform success, this research posed the two interrelated questions of (1) what are relevant IT and business capabilities of cloud platforms, and (2) what is their role in value creation and value appropriation. Addressing RQ1, we built on the literature and qualitative case insights from four distinct cloud platform ecosystems and in result provided a framework of three dyadic IT customization, four network IT standardization, and three business capabilities that are expected to affect value mechanisms in manifold and different ways (see Figure 2). Addressing RQ2, we employed a configurational perspective to identify the ways in which single value creation and appropriation mechanisms are enacted across the platform cases, which resulted in the identification of four pairs of alternative configurations that suffice to achieve novelty, complementarity, lock-in, and platform-resourcing outcomes (see Figure 3).

Consequently, the contribution from this research is two-fold. First, the derived framework not only instantiates the work of Rai and Tang (2014) for the cloud platform context, but also extends it by the three business capabilities and two additional value appropriation mechanisms (downstream services and platform resourcing). Although being bound to the specific cloud platform context, we argue theoretically that both the concept of business capabilities (understood as those capabilities being independent from the technological core of the cloud platform) as well as the two value appropriation mechanisms have potential relevance for other IT-enabled business models. In fact, the wider platform literature has emphasized business-related aspects of a platform such as pricing models (Evans 2013; Tiwana 2014), rules setting (Boudreau and Hagiu 2008; Hagiu 2014), and platform openness (Boudreau 2010; Eisenmann et al. 2009), although these have not been framed as capabilities and thus as a necessary resource for value creation. In addition, the two identified value appropriation mechanisms may have equal relevance for other ecosystem contexts.

Second, the exploration of successful configurations for selected value mechanisms emphasizes the complementary role of business and IT capabilities in that in all four pairs of configurations, selected business capabilities compensate for an absence or deficit of one or more IT capabilities, or vice versa. Summarizing these interactions, dyadic creation of services can compensate for lack of marketing and sales capabilities to achieve novelty (Prop. 1), marketing and sales capabilities can replace strong rules and architectural design capabilities to achieve complementarity (Prop. 2), superior portfolio management, incentives and rules can substitute process standardization for creating lock-in effects (Prop. 3), and dyadic transformation of service efforts can obviate the needs for defined rules, onboarding and modularization (Prop. 4). Although we do not claim exhaustiveness of these four alternative configurations that emerged from the cross-case analysis, we argue they do provide support for the necessity of including business capabilities in the extended Rai and Tang (2014) framework. Our propositions exhibit parallels to prior literature on industrial architecture (Tee and Gawer 2009), platform generativity (Henfridsson and Bygstad 2013; Yoo 2013), as well as envelopment and coring strategies (Gawer and Cusumano 2008; Tiwana et al. 2010).

The limitations of this exploratory research point to the future agenda in cloud platform research: First, although we strived for a diversified sample and found broad cross-case evidence for the different sub-categories, a different case selection may have yielded other alternative configurations of successful value mechanisms, thus that our configurational findings still remain somewhat provisional and demand validation in a larger sample. Second, we did not measure the success of each case with respect to value creation and appropriation, but relied on the judgement of research and market reports. The development of objective measurements for cloud platform value mechanisms could be a promising research avenue to strengthen comparability. Finally, we did not strive for completeness in terms of configurations for all value creation and appropriation mechanisms. Further research could address this shortcoming by developing objective measures and considering further contextual factors (such as industry architecture) with a larger sample in the emerging context of cloud platform ecosystems.

## **Appendix – Interview Guide**

Note: The interview questions were used as an aid for the interviewer to collect all relevant information on the phenomenon under investigation. Questions have been translated for the purpose of this display.

### **[Introduction of the interviewer, interviewee and purpose of the study]**

### **[Clarification of terms and specific concepts]**

#### **Value Creation and Value Appropriation**

Please describe your platform and the relating ecosystem (incl. service components).

Which customer segments are addressed within the ecosystem?

What are the strategic intents for interfirm collaboration?

How are the transactions structured and what activities are involved?

How do you create value with the platform? And how exactly? [new sales/ transactions, efficiency, complements]

Do you co-create value? If yes, how? [examples]

How do you appropriate value? How can you protect the value that has been created? [bundling, lock-In, barriers to imitation]

#### **Key Capabilities and Key Resources**

What are the required organizational capabilities to build and operate the platform and ecosystem? Are these rather relationship specific or network oriented?

What are the required technical capabilities to build and operate the platform and ecosystem? Are these rather relationship specific or network oriented?

Which are the technological assets of the platform? [complementary assets?]

Are there any other important assets (financial, reputation, structural)?

Are there any other immaterial assets (patents, scope, institutional)?

How do you govern the platform and the ecosystem? Who has decision and control rights?

Do you share market and ecosystem relevant information with your partners? If yes, in a systematic fashion or on-demand?

How do you observe and identify innovations for the platform? How do you implement these?

How do you handle interoperability in the platform ecosystem (APIs)? [proprietary vs. standardization]

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