Summer 6-15-2016

LEVERAGE ONCE, EARN REPEATEDLY – CAPABILITIES FOR CREATING AND APPROPRIATING VALUE IN CLOUD PLATFORM ECOSYSTEMS

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Complete Research

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Abstract

Information technology (IT) advancements enabled new delivery models (i.e. Cloud Computing), thereby facilitating the emergence of new business models in the IT industry, such as Cloud platform ecosystems. With their growing acceptance and diffusion in practice, we need a deeper understanding of their IT capabilities in order to implement their business model, thereby creating and appropriating value. We draw on empirical data from four case studies of Cloud platform ecosystems utilizing a framework on IT-enabled business models for data analysis. We found four key motivations for inter-firm collaboration that each generated business model requirements specified in the context of Cloud platform ecosystems. These drive the development of unique B2B IT capabilities enabling value creation and appropriation mechanisms. We propose three dyadic (relation-specific) IT customization and two network IT standardization (network-oriented) capabilities based on our cross case analysis. Furthermore, we describe prevalent value creation and appropriation mechanisms and suggest two additional mechanisms grounded in the data: downstream capabilities and platform resourcing. We provide a possible reasoning on the underlying logic of IT capabilities, value creation and appropriation of Cloud platform ecosystems.

Keywords: Cloud Platform Ecosystems, Value Creation, Value Appropriation, IT Capabilities.

1 Introduction

"As digital deepens, it's clear that hardcoded business and operating models won't suffice […] What's changed is that there's a shift to platform thinking. […] Platform concepts need to penetrate all aspects of a business."(Dave Aron, Vice President, Gartner (van der Meulen, 2015))

IT has enabled standardization and advancements resulting in changing delivery models of IT services (i.e. Cloud Computing) and the accompanying servitization in the IT industry (Cusumano, 2010; Leimeister, Riedl, Böhm and Krcmar, 2010). Traditional providers react by transforming their business models into service-centric approaches, resulting in e.g. market predictions of 22 Bln. US $ for Platform as a Service (PaaS) in 2019 (Carvalho et al., 2015). Within this paper, our understanding of Cloud platforms is the offering of IaaS, PaaS or SaaS or combinations thereof complemented with management services. Prominent examples are Salesforce.com App Cloud, Amazon AWS or Google Cloud Platform. We conceptualize these as platform ecosystems drawing on Tiwana et al. (2010) as a software-based platform that connects platform-specific module developers to end consumers (B2B) (or other developers) thereby acting as two-sided markets. Platform ecosystems combine the streams of product families (e.g. modularization and architecture) and market intermediaries (e.g. multi-sided markets) (Thomas, Autio and Gann, 2014). In practice, it is one of the most important concepts for progressing into digital business according to market researchers (van der Meulen, 2015) and consulting companies alike (Daugherty, Banerjee and Biltz, 2015). Yoo et al. (2010) emphasize that the emergence of software-based platforms is shifting competition and innovation toward platform ecosystems. These are able to create substantial competitive barriers for rival platforms and to foster value

creation through generativity and heterogeneity (Tiwana et al., 2010; Yoo et al., 2010). The combined offerings of Cloud platform ecosystems can exceed capacities and capabilities of what can be provided by any single company. Hence, the incentive for ecosystem participants lies in the generation of performance by leveraging complementary assets accessible through the platform (Iansiti and Levien, 2004; Adner and Kapoor, 2010; Thomas et al., 2014). This emphasizes the value creation potential of interfirm collaboration through platform-based business models. Best-practice firms for platform ecosystems (e.g. Apple, Google in mobile domain) excel in developing and leveraging IT capabilities to exchange content with partners, govern different types of interfirm relationships, and structure transactions in novel ways (Basole and Karla, 2011). Empirical evidence suggests that value creation and appropriation are affected by firm's business model – which is operationalized by its (IT) capabilities (Rai and Tang, 2014). Therefore, we argue that the underlying logic Cloud platform ecosystems´ IT capabilities to operationalize the business model and eventually to create and appropriate value is an important - but understudied - phenomenon.

Within the information systems (IS) literature, Yoo et al. (2010) highlight the necessity for more research on the phenomenon of platform-centric ecosystems. In line with a call of the IS community, we will approach (IT-enabled) business models within the IT industry (Cloud) and their respective mechanisms to create and appropriate value (Veit et al., 2014). We argue that this is especially important in the case of Cloud platform ecosystems given the variety of participants engage in resource generation and integration. There exists little research within our area of enquiry. Scholars have researched on value co-creation and value appropriation in platform ecosystems of ERP standard software (Ceccagnoli, Forman, Huang and Wu, 2012; Huang, Ceccagnoli, Forman and Wu, 2012; Suprateek Sarker, Sarker, Sahaym and Bjørn-Andersen, 2012). Alike, value co-creation has also been explored within the cloud platform context within a single case study of an IaaS provider (Huntgeburth, Blaschke and Hauff, 2015). These studies are not discussing value creation and appropriation in relationship with the necessary IT capabilities required to implement the business model. Furthermore, preferences of PaaS consumers have been studied (Giessmann and Stanoevska-Slabeva, 2012b) as well as business models of PaaS platforms in terms of typology (Giessmann and Stanoevska-Slabeva, 2012a), dynamics, simulation and construction (Giessmann and Legner, 2013; Giessmann, Fritz, Caton and Legner, 2013; Giessmann, Kyas, Tyrväinen and Stanoevska, 2014). Again, these studies do not provide insights on the IT capabilities required to implement the business model. Thereby we will contribute to the research streams by offering another perspective on value creation and appropriation within the context of IT-enabled business models. Thus, we are addressing this research gap by examining the following research question: How do Cloud platforms create and appropriate value and which kinds of IT capabilities do they require?

The remainder of the paper is structured as follows. Section two introduces Rai and Tang´s (2014) framework on IT-enabled business models which we utilized as our theoretical lens. In section three, we describe the background of our case studies and methodology in terms of data collection and analysis in detail. Section four presents the results and interpretation of our empirical study. Eventually, section five highlights this study's contributions to research and practice.

2 Theoretical Background

The business model (BM) is an important but understudied phenomenon, which affects value creation and appropriation besides accepted influence factors such as product-market-strategy and industry factors (e.g. speed of innovation) (Zott and Amit, 2008; Rai and Tang, 2014). Furthermore, it is becoming widely acknowledged that IT-enabled business models are a distinct source of value creation and appropriation (Zott and Amit, 2007; Teece, 2010). In this sense, the IT-enabled BM represents how interfirm exchanges and transactions with customers, suppliers or partners are structured and executed (Rai and Tang, 2014). Despite the general recognition of the IT´s critical role in enabling BMs (see e.g. Amit and Zott, 2012), the relationship between IT enablement (through IT capabilities) and BMs has received limited attention (Rai and Tang, 2014). Therefore, Rai and Tang (2014) addressed this gap by proposing a framework for business value from IT-enabled business models (see Figure 1). We utilized this framework as our theoretical lens as it provides a general understanding on

the relationship between the strategic intent for interfirm collaboration, the respective business models requirements and the implementation through IT capabilities resulting in value creation and appropriation.

The first pillar of the framework is represented by the strategic intents of a company considering not only product market fit but also in terms of how to structure interfirm collaboration (Christensen, 2001). They operationalize this concept with five key strategic motivations for interfirm collaboration: (1) to achieve supply chain efficiencies, (2) to develop market responsiveness, (3) to design, develop, and/or commercialize innovative offerings, (4) to develop markets and customer relationships, and (5) to generate complementarities. The second pillar is driven by the recognition that each strategic intent results in BM design requirements. These comprise the following three constitutive elements (Amit and Zott, 2001): (1) content: goods or information exchanged with partners, (2) governance: control of goods/information (incl. legal form of organization, participants incentives), and (3) transaction structure: parties involved and the ways how they exchange. Accordingly, these design requirements induce a focal firm to develop specific B2B IT capabilities which are 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). They further argue that two IT capabilities need to be acquired functioning at distinct levels: (1) IT customization at the dyadic interfirm level, and (2) IT standardization at the network level. Dyadic IT customization considers idiosyncratic (i.e. relationship specific) requirements in a single relationship for the sharing of information, its governance and transaction structure. Examples include build-to-order interfaces to exchange custom information and/or tailor business rules and processes to ensure proper collaboration (Turnbull, 1991; Broadbent, Weill and St. Clair, 1999). In contrast, the focal firm´s ability to leverage modularized IT resources and standards for facilitating information exchange describes network IT standardization. Thereby common process for data exchange or activity structuring can be leveraged in order to hamper the need for relationship specific investments (Ross and Beath, 2006; Malhotra, Gosain and El Sawy, 2007). Through these IT B2B capabilities, the business model is implemented in conjunction with value creation and appropriation mechanisms. Value creation mechanisms describe the strategies in order to create value for all stakeholders involved and specify the upper limit of value that can be captured (Brandenburger and Stuart, 1996). The three main mechanisms from Amit and Zott´s (2001) work are used: (1) Novelty, (2) Efficiency, and (3) Complementarity. By drawing on Teece (2010) they suggest three value appropriation mechanisms: (1) Bundling, (2) Lock-in and (3) Barrier to imitation. As a feedback loop, Rai and Tang (2014) suggest that based on the market performance, either the implementation of the BM is adjusted (IT capabilities, value creation and/ or appropriation) or the strategic intent needs to be adapted also resulting in an adjusted implementation.

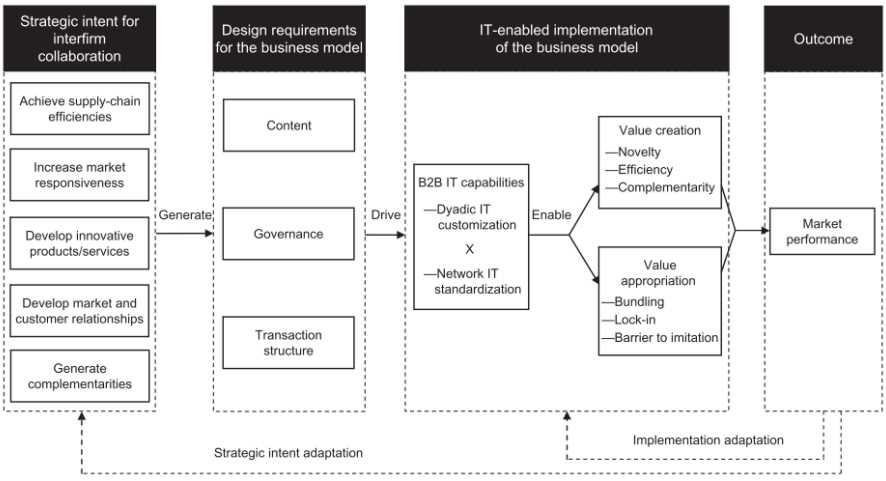

Figure 1. Framework: Business Value from IT-Enabled Business Model (Rai and Tang, 2014).

3 Research Design

In this paper we employ an explorative multiple case study approach in the spirit of Eisenhardt and Graebner (2014). We opted for an interpretative case study approach since the phenomenon in practice is relatively new and practitioners as a source for information may be subject to different terminology still indicating the same meaning (Walsham, 1995; Klein and Myers, 1999). Thus, we were able to better explore phenomena by accessing these meanings and thereby better capture ideas and actions in organizational contexts (Klein and Myers, 1999). We believe that this understanding is essential in order to draw conclusions embedded into organizational contexts. As research on Cloud platforms is still in its infancy, our exploratory approach is particularly useful to discover not anticipated features or facets (Klein and Myers, 1999). In that, we have chosen a diverse sampling strategy looking for cases that clearly adopted and represented one of the five key motivations for interfirm collaboration (Seawright and Gerring, 2008). Thereby, we strive for case heterogeneity only in this dimension while ensuring equality with respect to its business model (Cloud platform for B2B enterprise software). This results in higher representativeness of our cross case results (Seawright and Gerring, 2008). We employed market research utilizing reports from market research institutes (e.g. Gartner, IDC, Forrester, Experton) on Cloud Platforms ('PaaS','aPaaS', 'iPaaS', 'Application Platform') in order to identify case candidates. We opted for market leading Cloud platforms to ensure that only cases with appropriate market performance are selected. Furthermore, it is important to understand that these platforms offer a combination of strategic intents to a different degree. We looked for the most prominent strategic intent in each of these cases by comparing the strength and frequency of the mentioned concepts. Matching of these cases to strategic intents was done based on a pre-study (Hahn, Röher and Zarnekow, 2015) utilizing secondary data (web pages, FAQs etc.) and will be further elaborated within the analysis section. Figure 2 shows the matching of strategic intents and our selected cases with a short context description. We have not yet identified a case that primarily aims at achieving supply-chain efficiencies.

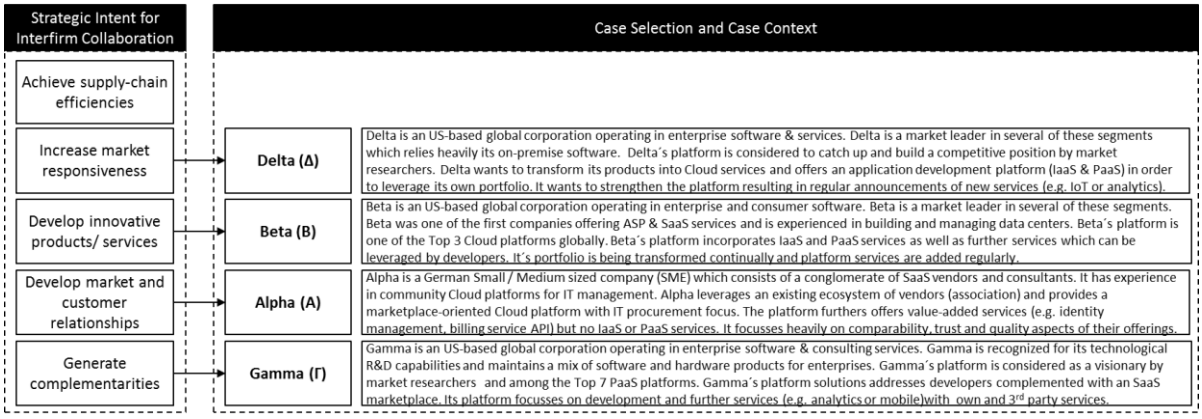

Figure 2. Case Matching and Case Context.

By relying on a semi-structured interview guide with open-ended questions, we made sure to include all relevant aspects with a shared understanding while at the same time giving interviewees the freedom to enrich the discussion with aspect of his/ her particular interest. The interview guideline was structured into the following four segments: (1) Introduction (role, experience, common agreement on terms), (2) Strategic intent, platform functionalities, transaction structure & governance, (3) Value creation and appropriation and (4) Key capabilities and resources. Based on the methodological guidelines of Sarker and Sarker (2009) we chose suitable interviewees. In particular, we explicitly looked for product managers, sales managers or partner managers of the identified platforms thereby ensuring appropriate experience and knowledge in the (architectural) design and value proposition. We opted for complementary roles of interviewees within a case to increase data triangulation and validity. A summary of the research project´s objectives and interview guide have been sent upfront to ensure appropriate knowledge. We also considered other documents and information – either publicly available or received from the interviewee. In particular, we looked into company presentations, brochures,

FAQs, videos and accessed the platform itself where possible. The interviews were scheduled between August and October 2015 of which three have been conducted face to face and five via phone. Interviews were held in German, 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, 454 minutes were recorded and the transcribed material amounted to 43.042 words. Table 1 describes the interviewer details for each case.

Case #	Interviewer Position	Size	Date	Duration / Transcription size
Alpha (A)	C-Level (CMO) (A#1)	SME	08/2015	55 min. / 6.102 words
	C-Level (CEO) (A#2)	SME	09/2015	59 min. / 5.132 words
Beta (B)	Partner Business Development (B#1)	Corp.	08/2015	48 min / 4.335 words
	Senior Technical Consultant (B#2)	Corp.	09/2015	55 min / 5.705 words
Gamma (Γ)	Platform Product Manager (Γ#1)	Corp.	09/2015	55 min / 5.376 words
	Sales Manager Europe (Γ#2)	Corp.	10/2015	41 min / 3.630 words
Delta (Δ)	Sales Manager Europe (Δ#1)	Corp.	09/2015	62 min / 6.210 words
	Senior Technical Consultant (Δ#2)	Corp.	10/2015	79 min / 6.552 words

Table 1. Profiles of the Interviewees and Interview details.

Overall, we followed the methodological guidelines summarized by Sarker and Sarker (2009) to ensure rigorous data analysis and representation and applied conceptual coding as a tool in qualitative research to support data complexity reduction. Furthermore, we relied on a priori codes for our concepts based on the dimensions of IT-enabled business models framework (Rai and Tang, 2014). We also applied conceptual coding in order to specify framework, utilizing its dimensions as category families. For example, the capability of standardizing a trading process was coded as 'Network IT Capability: Process Standardization'. Coding was performed with the help of qualitative research software tool ATLAS.ti 7. The constant comparative process involved data triangulation, i.e. whenever possible, we compared responses across interviewees, platform cases, and organizational roles of respondents (Patton, 2002).

4 Results and Interpretation

In the following section we will present the within-case analyses of the four cases, thereby empirically validating the framework of Rai and Tang (2014) and extending it to the emerging context of cloud platform ecosystems. We will utilize empirical evidence from the interviews, documents and other sources to develop a contextual understanding of IT-enabled business models for Cloud platform ecosystems.

4.1 Within-Case Analysis

Case Alpha (A). The dominant strategic intent of the first case organization is to develop market and customer relationships. This is apparent in the *content* aspect of the *business model design requirements* as they provide market intelligence, product entry, distribution strategies and personalized content. Market intelligence is provided in a wide choice of substitute SaaS services, which are presented in a standardized way with the same level of information as well as efficient processes for procurement and transaction execution. (***A#2.1***:*„We are organizing the whole procurement process which includes the catalogue portfolio and the platform […] and the delivery processes as well […]"*). Further, we found that Alpha tackles customer experience that calls for quality and trust assurance, customer ratings, recommendations, searching functionalities as well as complementary professional services (e.g. IT consulting).(***A#1.1:****„ [Our goal is] to offer the largest catalogue possible[…]. […]we would like all solutions to present in the same standardized way[…] categorized by certain criteria, industry, domain, expertise, trust-level.[…] [We will integrate additional functionalities such*

as]identity management, central billing and invoicing […] which are standardized processes.[…] differentiator is the offering of complimentary professional services (e.g. implementation).”).

In terms of *governance,* the Cloud platform incorporates an electronic marketplace (EM) that presents the SaaS offerings in the previously described manner. The platform further automatizes the standard procurement and transaction processes (incl. delivery). (***A#1.2:***„*We as a sales channel take over a part of our partner´s job.[We will integrate] recommendations and reviews […]. We are trying to standardize all interfaces. Proprietary would be contrary to our approach of being an open platform […]”).*With their approach, Alpha offers independent software vendors (ISVs) two novel distribution channels. The first channel represents online sales directly via their public cloud platform (see A#1.2). The second utilizes multipliers with an established end-customer base relying on the (customized) cloud platform. Thereby, the *transaction structure* is expanded with additional sellers previously not selling software. (***A#2.2***:„*We are not confident 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. […]”*).

Alpha has developed a set of *IT capabilities* in order to implement their business model. *Dyadic IT customization capabilities* can be found in the process of including a SaaS solution into the catalogue. This involves the technical integration to enable platform services (e.g., Single-Sign-On (SSO) or billing) and the quality check and trust rating given by the platform. At this stage, often business model development activities (pricing model or marketing) are supported by the platform as well (***A#1.3***:„*Since we all want to present them [SaaS solutions] equally, we do some business development for our partners. […] The platform configurability allows us to adapt very flexibly […] offering different integration levels[…]”*). In addition, the customization of the public platform into a sub-store for each multiplier in terms of individual requirements (i.e. design or specific catalogue) is a dyadic capability. Alpha has also developed a set of *network IT standardization capabilities*. In particular, they developed a standardized service description, price information and trust information to display each SaaS solution. The procurement process of end-customers and the resulting transaction (incl. delivery and payment) process have also been automated and standardized (***A#2.3***:„*you need to categorize the whole catalogue portfolio […] which requires a lot of time and know-how[and] extensive process understanding“*). Standardized interfaces have been implemented for integration of the value-added services (e.g. SSO). In the same vein, the architecture of the platform is prepared to allow for the creation of “sub-stores”.

In terms of *value creation*, Alpha achieves *novelty* by providing novel distribution channels. *Efficiency* is created by automating and handling transaction processes for both parties as well as enabling efficient information search (cf. electronic marketplaces). Offering enhancing platform services (e.g. SSO, billing) for complementary modules results in the creation of *complementarity*. When it comes to *value appropriation*, Alpha *bundles* the aforementioned platform services into one offering with a price model consisting of a listing fee and success-based revenue share. Alpha also highlighted their independent access to a cloud ISV ecosystem as a *barrier to imitation*.

Case Beta (B). The dominant strategic intent of Beta is to develop innovative services. The *business model design requirements* therefore consider the following aspects within the *content* dimension. Customer requirements of ISVs are followed in the form of processes, tools and architecture for SaaS application development and operations. Product ideas and breakthrough concepts are provided by several innovative platform modules (e.g. IoT, advanced analytics etc.) that can be used to develop new services. These modules capture knowledge and skills which can now be accessed by ISVs that had not had access before (***B#1.1***: *„The central value proposition is to help ISVs to focus on their core competencies enabling them to innovate by providing them with platform services. […]such as machine learning and just use it like building blocks”*). Market intelligence is provided by partner business development roles that advise ISVs and developers on business model and monetization strategies (***B#1.2***:*„The central task of my role is to make partner solutions successful[…], we market them[…] and help go-to-market activities and build a sustainable business model.”*). Within this strategic intent g*overnance* requires knowledge integration across the focal firm’s boundaries and encapsulation of intellectual property (IP). Beta achieves the knowledge integration via a combination of

platform functionalities and individual consulting for partners. The platform offers modularized services for application development and operations as well as other modules for specific areas (e.g. IoT or analytics). When new services are developed by ISVs these are encapsulated as a new solution that runs on the platform. IP rights remain with the ISV/ developer (***B#1.3***:*„If these solutions meet the quality criteria they can be listed [in the marketplace] thus offering a new sales channel […] IP rights remain with developers."*). The platform takes over tasks of developers or system houses thereby changing the 'traditional' *transaction structure* of enterprise application development and operations. Third party developers are incentivized by increased sales potential to offer their knowledge as platform services. The platform offers knowledge transfer through dedicated platform services, processes and documentation (incl. communities). These are complemented with a marketplace that helps to market and sell these newly developed SaaS services.

In the following, we will describe the *IT capabilities* Beta has developed to implement the design requirements. *Dyadic IT customization capabilities* can be found in the process of transforming existing solutions into a platform compatible architecture or by enabling hybrid architectures. Technical and business consulting is both dyadic in nature but helps to leverage the platform appropriately (***B#1.4***: *„One of our biggest advantages is the large portfolio […]transformed into services as separate modules"*). Quality assurance of SaaS services that should be marketed via the marketplace is a dyadic capability as well. Beta has also developed a set of *network IT standardization capabilities* which can be manifested in the following aspects. In particular, the platform offers standardized tools and process for application development and operations (incl. the management of these services) (***B#1.5***: *„It is of utmost importance to be highly available and […] fully automated infrastructure.[…] capabilities of managing data centers and services on a high security level, appropriate management processes"*). The platform offers flexible interface architecture to extend new services (modules) (***B#2.1***: *„Openness […] means that I can not only use proprietary languages and technologies […]. We offer SDKs [or] a developer can use the underlying RESTful API […] which are documented."*). This includes the provision of self-learning and exchange mechanisms (tutorials, documentation and communities. In order to leverage marketing and sales knowhow as well as existing channels, a marketplace has been set up that offers value-added services such as central invoicing. The encapsulation of intellectual property has also been manifested in a set of agreed terms of services.

In the case of Beta, *value is created* in all three dimensions: *novelty*, *efficiency* and *complementarity*. *Novelty* is provided by the provision of additional sales channel (i.e. marketplace) that helps to market and sell these newly developed SaaS and add-ons. *Efficiency* is created by offering standardized development and operations environment that takes away effort from the developer (see #B2.1). Complementarity is achieved through the ability to build innovative services relying on other services and infrastructure and making some newly developed services reusable for other developers (***B#1.6***:*„There are numerous add-ins or plug-ins for other solutions which can be sold via the marketplace […].*"). In terms of *value appropriation*, Beta *bundles* the aforementioned platform services into one offering and charges for the infrastructure that is used (***B#2.2***:*„The more this partner service is used, the more hardware resources are consumed."). Lock-in*, though not intended, occurs inevitably via knowledge dependence on certain services and modules provided by Beta´s platform. Another mechanism we noticed concerns the reusability of third party developed services. These third party modules (e.g. 'add-ins') thereby extend the core platform service and increase the total value of the platform, usually known as indirect network effects. In the context of cloud platform, this extended platform core leads to increased platform users and increased revenue for the platform provider.

Case Gamma (Γ). The dominant strategic intent of Gamma is to generate complementarities. In the following, we will illustrate the *business model design requirements* for Gamma beginning with the *content* dimension. A catalogue of different developer services is provided which can be used to develop complementarities. These services range from development kits (SDKs) to infrastructure and operation services. Furthermore, more specific services which require deep expert knowledge are made available as well (***Γ#2.1***:*„It is one of our strategic intents to be the platform where cool and innovative ideas are implemented […]We have about 140 pre-configured developer services in our catalogue supporting in quite different areas, such as IoT, cognitive services,[…]"*). The interface

specifications are publicly available to all interested parties. These complementarities can then be included in the catalogue of developer services as well, which means other developers can reuse these services in their own solution (***Γ#1.1****:„These services are not only complementary solutions but also services in direct competition with our own from third party providers.[…]It is very easy to integrate these as building blocks in a similar way for developers"*). *Governance* requires the support of industry standards (and the control of complements in terms of quality, intellectual property as well as availability and compatibility through the platform itself (***Γ#1.2****:„We [product managers] control the catalogue of developer services[..] and decide according a list of quality measures[…] since we only want high quality services to be offered"*). The *transaction structure* consists mainly of the interaction of services in horizontal (infrastructure, operations etc.) and vertical (analytics, special services) relationships). These complements are then encapsulated and IP rights remain with the developers. The platform then offers two ways of support in terms of marketing and sales: (1) integration into catalogue of developer services, (2) marketplace for stand-alone SaaS solutions.

Gamma has developed a set of *IT capabilities* derived from their *business model requirements*. *Dyadic IT customization* capabilities have evolved around the control of the complements, which includes quality assurance as well as IP considerations and legal agreements (***Γ#1.3****:„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.[…] IP rights remain with the developer"*). Business development and technical consulting are also offered (***Γ#1.4****:„We offer on-site service where our top-programmers collaborate with clients […] to support customers."*). The transformation of existing products into complements that are compatible with the platform architecture is also dyadic in nature. Gamma has developed a set of *network IT standardization capabilities*. In particular, the platform offers standardized tools and processes for application development and operations (incl. management of these services). The platform offers a flexible interface architecture to extend new services (modules) and supports standards that allow developers to just 'push' the code onto the platform. Additionally, the ability to offer, extend and transform an extensive catalogue of reusable developer services (incl. encapsulated complements) is of utmost importance . These services are partially very specific and extensively enrich the knowledge base of developers (e.g. cognitive services). Therefore, documentation on how to use and apply these is crucial. The capabilities to support in market and sales activities for these complements have also been highlighted.

Gamma *creates value* in all three dimensions: *novelty*, *efficiency* and *complementarity*. *Novelty* is provided by new distribution and monetization channels through the possibility to list new solutions in developer services catalogue or in the SaaS marketplace. *Efficiency* is created by offering standardized development and operations environment that takes away effort from the developer. *Complementarity* is achieved through the development of services that complement the developer service and platform portfolio, which then can be used as building blocks by other developers. Gamma *appropriates value* in several ways. Basic platform services are *bundled* and charged based on usage parameters (used storage, no. of transactions etc.) (***Γ#1.5****:„We are charging based on the executed code on the platform (used main memory etc.) which is free within a certain threshold[…] And you pay extra for used optional services as well […]"*). A success-based revenue share has to be paid when third party services are consumed via the developer service catalogue or marketplace. *Barrier to imitation* are installed by patented services that also require enormous hardware capacities. In addition, Gamma offers downstream capabilities that are billed separately such as IT implementation services. We found a strong mechanism that extends the value of the platform. By incorporating complements into the service catalogue that can be recombined, the platform expands in its scope and offerings. Thus, other developers can develop even better solutions by reusing these building blocks. We found this mechanism to be stronger than in the case of Beta, since here exists a separate catalogue for developer services appearing as if it belongs to the platform (***Γ#1.6****:„We asked an existing partner […] to offer his existing SaaS solution for end-customers encapsulated with an API for developers"*).

Case Delta (Δ). The dominant strategic intent in Delta´s Cloud platform business model is to increase market responsiveness so that capacity (infrastructure for operations and development) can be scaled efficiently. *Content-wise* Delta has considered the requirements by enabling a flexible switching be-

tween on premise and hybrid operations to react to performance peaks (***Δ#1.1***:*„This enables our customers to do load-balancing, migrate into hybrid scenarios, to buffer peak loads etc.[…] This is it: I want to be faster, seize market opportunities and not be slowed down by typical IT processes"*). This further allows the transformation of development test environments into productive environments without much effort (***Δ#1.2***:*„All activities for test and development can be done within the cloud which is 60-70% in some companies."*). In terms of *governance*, switching costs are reduced by only offering high quality ('best of breed') solutions from the portfolio of the platform owner, which are pre-integrated. Furthermore, while switching between on premise and hybrid operations the same software is provided (***Δ#2.1:***„ *Therefore we are bridging by mirroring the possibilities of a public Cloud into the private Cloud […] with exactly the same software and functionalities."*). Hardly any 3rd party services are offered which reduce governance effort for these. The *transaction structure* calls for dyadic collaboration for relationship adaption which is enabled by the platform and the aforementioned mechanisms. These coordinate relationship specific signalling and enable specific adaption as well as unifying activities across the traditional value chain (e.g. application development and operations infrastructure)

Delta has acquired *IT capabilities* in both dimensions, *dyadic IT customization* and *network IT standardization*. The former can be manifested in a post-sales consulting organisation and adjacent IT consulting services (***Δ#1.3***:*„We have a customer success manager organisation that consults the customer after sales for free […]."*). The integration of services and products into relationship specific services, such as the administration console is an individual task. Delta also has to transform and pre-integrate further products and services from their own and 3rd party portfolio into platform services and SaaS solutions (***Δ#1.4***:*„It is our goal that all these applications [Delta´s SaaS] are available on the platform and can be integrated […] via open standards.*). Furthermore, existing solutions of customers also need to be transformed into a platform compatible architecture (***Δ#1.5***:*„We are collaborating with system integrators to support our platform by enabling them to join our platform[…]."*). Delta has developed a set of n*etwork IT standardization capabilities* in order to leverage their business model. The administration console is able to work with the full stack of platform services. The platform itself also offers infrastructure, operation and development services as well as SaaS solutions. Delta has also developed standard requirements for operations on the platform, which enables scaling functionality. All functionalities of the platform and its services are documented and available for learning purposes.

In Delta´s case, we find two *value creation* mechanisms to be present as well. By providing a new mechanism for hybrid solution architectures and operations enabling responsiveness, Delta achieves *efficiency.* Furthermore, efficiency can be found by offering standardized development and operations environment that takes away effort from the developer. In addition, the administration console for pre-integrated solutions also fosters efficiency. Through leveraging their existing applications portfolio and installed base as well as consulting services, Delta utilizes complementarity as a value creation mechanism. We found three mechanisms for *value appropriation* in place: *bundling*, *lock-in* and *downstream capabilities*. The bundle consists of basic platform services that are charged based on usage parameters (used storage, no. transactions etc.) with post-sales consulting services for free. *Lock-in* effects are established by offering a rather closed portfolio of these pre-integrated services (mostly provided by platform owner) (***Δ#1.6***:*„ We want to increase our application business via platform and its integration and vice versa.[…] This is the strategy behind, lock-in is a strong driver […]"*). Furthermore, the consistent familiarity and ease of use of the platform tools (incl. administration console) will add to that. In addition, Delta offers *downstream capabilities* that are billed separately such as IT consulting and implementation services. In addition, based on their installed base cross selling and upselling opportunities are methods to capture further value.

4.2 Cross-Case Analysis and Discussion

This section provides a cross case analysis and discusses this in light of an underlying logic of IT capabilities, value creation and appropriation. First, we will introduce the results of our case comparison. Second, we address the validity of the framework in our context. Last, we will draw conclusions in the

context of Cloud platform ecosystems that are enabled by the framework. Table 2 summarizes the findings of our within-case analysis.

		Alpha (A)	Beta (B)	Gamma (Γ)	Delta (Δ)
IT Capabilities	Dyadic IT cust.	• Onboarding solutions (incl. integration, quality approval) • Consulting & Advisory for partners • Platform customization for sales partners	• Transforming solutions into platform architectures • Consulting & Advisory for partners • Onboarding solutions (incl. integration, quality approval)	• Onboarding solutions (incl. quality approval, IP, legal) • Consulting & Advisory for partners • Transforming solutions into platform architectures	• Consulting & Advisory for partners • Integration of solutions into platform architecture • Transforming solutions into platform architectures
	Network IT stand.	• Standardized processes & information for SaaS transactions • Standardized interfaces for onboarding with architectural planning for customization	• Standardizing development, operations & transaction processes & governance • Architectural flexibility through standardized APIs • Learning resources (e.g. FAQs)	• Standardizing development, operations & transaction processes & governance • Architectural flexibility through standardized APIs • Catalogue service management for new services & complements • Marketing & sales support • Learning resources	• Standardizing application development, integration and operations processes • Learning resources (e.g. FAQs) & platform services free for testing
Value Creation		• Novelty: new sales channels for SaaS and consulting services • Efficiency: automating procurement and transaction processes • Offering enriching platform services (e.g. SSO, billing)	• Novelty: enabling new sales channels for SaaS and complements • Efficiency: standardized development & operations processes • Complementarity: enabling development of innovative services, add-ons or (re-) combinability of these	• Novelty: enabling new sales channels for SaaS and complements • Efficiency: automating procurement and transaction processes • Complementary: enabling development of innovative complementary platform services	• Efficiency: automating enterprises business processes (pre-integration); Enabling hybrid architectures & responsiveness • Complementary: leveraging existing portfolio & professional services to create complements (SaaS)
Value Appropriation		• Bundling: platform services with revenue sharing • Barrier to imitation through vendor ecosystem	• Bundling: platform services based on infrastructure usage • Unintended lock-in through dependence on services • *Platform resourcing*: extend scope through integration of 3rd party modules	• Bundling: platform services with revenue sharing • Barrier to imitation: few IP protected services • *Downstream capabilities* (billable consulting) • *Platform resourcing*: extend scope through integration of 3rd party modules	• Bundling of platform services based on infrastructure usage • Lock-in: through closed platform ecosystem • *Downstream capabilities* (billable consulting)

Table 2. Summary of the Case Results (IT Capabilities, Value Creation and Appropriation) (new concepts in Italics).

In terms of novel findings - enabled by using the framework as theoretical lens – based on our sampling strategy it is apparent that all four cases differ in terms of their dominant strategic intent for interfirm collaboration. The resulting business model requirements instantiations vary widely. Nonetheless, we can generalize that dyadic IT customization capabilities revolve around three streams in the context of cloud platforms: (1) Transforming and integrating products/ services into platform services (own portfolio or third party), (2) Onboarding (incl. quality assurance, connecting to interfaces for platform integration and added-value services) and integrating existing solutions of customers onto the platform, and (3) Individual familiarization, such as IT consulting. The transformation of products or services into platform services aims at increasing its functionality and scope. Onboarding describes the mechanism of bringing complements (e.g. add-ons or 3rd party platform services) on the platform. In light of existing theory, this relates to solving essential system or business problems acting as the core of a platform (Gawer and Cusumano, 2008). Within our study, all cases had IT products before which solved a range of these problems but needed to be transformed and integrated under the umbrella of the platform. Further, this also comprises the facilitation of external companies provision of complements and developing unique, compelling features in order to attract users representing a part of the 'coring' and 'tipping' strategy described by Gawer and Cusumano (2008). Individual familiarization (e.g. IT consulting) refers to the capabilities of the platform provider of getting used to the platform

(e.g technical standards) and receiving (individual) support. This has been found as a factor of perceived openness in mobile platform ecosystems (Hilkert, Benlian, Sarstedt and Hess, 2011) increasing complementors´ satisfaction. Similarly, network IT standardization capabilities differ in detail but we can also draw some general tendencies: (1) Standardization of processes, information exchange formats as well as rules and regulations for participation within a platform, and (2) Modularization of the platform and its services with standardized interfaces in order to adapt to changing environments and requirements.

In terms of process standardization, we found that e.g. application development processes or application sourcing and transactions processes are standardized in order to increase efficiency. Nonetheless, these processes rather leave choices for individual ecosystem participants instead of commoditizing the process altogether (see e.g. Markus and Loebbecke, 2013). Information exchange formats in this context relate to processing the information (e.g. product descriptions, invoicing information, programming code exchange etc.) which is discussed within the intermediary literature stream (see e.g. Muylle and Basu, 2008). Specific to application development processes, standardization frameworks such as Cloud Foundry or OpenShift or container technologies (such as Docker) for transferring applications within different environments may play a crucial role. It further comprises requirements that must be fulfilled in order to participate within the ecosystem (quality norms, support, legal agreements) relating to further standardization and ensure quality of the platform (see e.g. Wareham, Fox and Cano Giner, 2014). When it comes to modularization of the platform, our cases highlighted the need for architectural planning and interface design. In all cases, we found that interfaces were designed according to open standards (REST API) and documentation was publicly available. The platform itself consisted of modularized platform services as well in order to give customers the choice on what to use. Recent literature highlighted the need of modularization in platform architectures (Baldwin and Woodard, 2008) including its fit with platform governance (Tiwana et al., 2010). Especially in terms of innovation platforms it is proposed that modularity is essentially changing the business architecture of different industries and markets alongside with interconnected data (Venkatraman and Pavlou, 2014).

When it comes to value creation, almost all three mechanisms have been used by each case (except Delta) but they all differ in detail. Our empirical data suggests that in three cases, efficiency is provided by offering an application development and operations platform (IaaS & PaaS), standardizing enterprise processes by pre-integration or supporting the execution of procurement processes. Likewise, three cases offer additional sales channels in order to create novelty. Most notably, in the case of Alpha where the end customer access will be provided via sales multipliers. Complementarity is further created through the development of innovative services, which are supported by platform services. Gamma is strongly supporting the notion of innovative applications through assembling 'building blocks' (platform services). We propose that this can be interpreted as the recombination of malleable resources and resembles the generative innovation mechanism in digital infrastructures (Henfridsson and Bygstad, 2013). Further value creation through complementarity occurs in order to develop extensions or add-ons for existing applications or platform services (see e.g. Lavie, 2007).

The most prominent appropriation mechanism - employed by all cases - 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. The pricing mechanism is then based on the infrastructure that is consumed. In the case of Delta, these services can be used for free until the application is deployed. Although, lock-in is not intended as an appropriation mechanism, it still occurs to a certain extent through technological (specific service APIs) and organizational (processes, governance) structures. By supporting industry standards (Docker, Cloud Foundry), our case organizations want to prevent technological lock-in and instead persuade complementors by offering superiors services. Barrier to imitation only plays a minor role in value appropriation since IP rights on software are hard to protect. Only few specific platform services with high knowledge are considered as IP protected property. Based on our data, we extended the value appropriation dimension with two additional mechanisms: (1) Platform resourcing, (2) Downstream capabilities. We propose the notion of 'platform resourcing' for platforms whose strategic intent is to develop innovations

or to generate complementarities as a mechanism to capture the service developed via the platform to extend the platform core and its functionality base. We think that this relates to the increase of scope and reach by integrating partner solutions and resembles the generative scaling mechanism in digital infrastructures (Henfridsson and Bygstad, 2013). Downstream capabilities represent unique knowledge and can be translated into e.g. software consulting services (Grover and Kohli, 2012; Huang et al., 2012). The three cases that employ these downstream capabilities have not built these capabilities specifically for the platform. We think that these complementary professional services help lower the entry barriers and fit into a value co-creation oriented strategy (see e.g. Huang et al., 2012; Huntgeburth et al., 2015). Figure 3 summarizes our cross case findings.

Based on our empirical data, we are able to show that the framework is robust enough to capture the findings in our context. We could assign our empirical data to the (sub-) dimensions from strategic intent to business model design requirements into the IT-enabled implementation. From our perspective, this can be taken as an indicator for the suitability of the framework as theoretical lens.

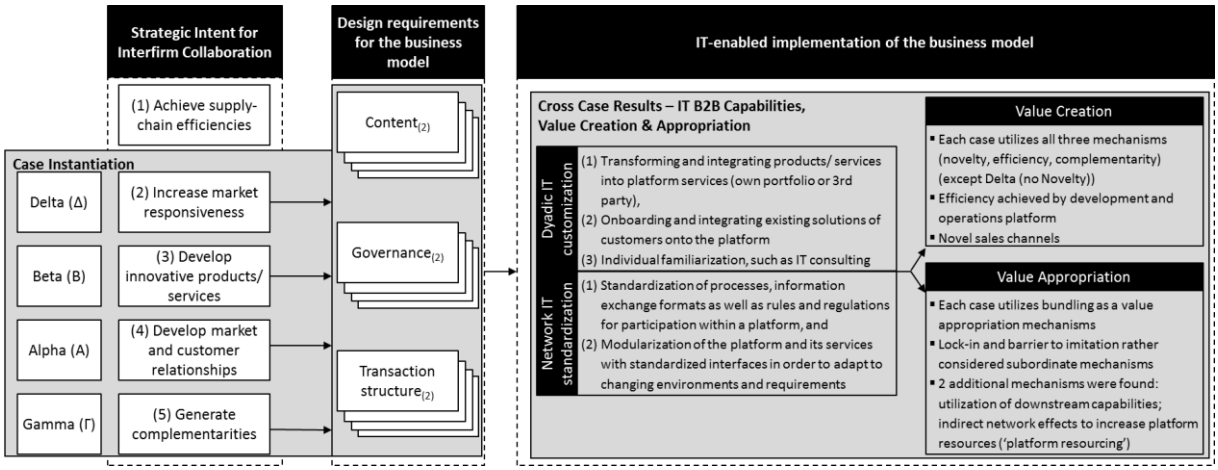

Figure 3. Cross Case Results and Summary of Contribution.

The distribution of strategic intents and resulting BM requirements may underline the different needs in the enterprise Cloud application market and their respective priorities inferred by platform providers. We would also deduce from this finding that there exist different interpretations of product-market-fit targeting slightly different customer segments. At first sight, it may seem contradictory that platform-centric business models still require so many multifaceted dyadic IT capabilities. We think that the dyadic capabilities are necessary to advance the platform or to decrease entry barriers by providing familiarization services (e.g. consulting) or transforming solutions into platform compatible architecture. The network standardization capabilities are then required to multiply the possible value that is created on a much larger scale. Hence, once a solution is on the platform more value can be created by e.g. providing mechanisms to upscale infrastructure, to expand the solutions with further pre-integrated modules or providing additional sales channels. This is especially interesting because the cases differ in their strategic intent but still employ similar value creation strategies. In line with our previous argumentation, we would further conclude that there exists a variety of market needs of slightly different customer segments and every platform tries to create the largest value possible combining these strategies. We would further argue that once developers and services are on the platform, it is easier to provide additional services to increase value generation.

We infer that this also relates to the value appropriation strategies, especially bundling as the most prominent. The underlying mechanisms here are dynamic, i.e. grow with an increased usage of the platform infrastructure and services. Furthermore, we think there is a reinforcing effect that takes advantage of indirect network effects to capture more value by extending the resource base of the platform (e.g. Gamma (generate complementarities) and Beta (develop innovative services)). Additionally, the companies that offer consulting services use these downstream capabilities in order to capture additional value. Based on our pre-understanding, we will now outline aspects that have been raised by our interviewees but could not be considered directly within the framework. First, it does not dif-

ferentiate between the modes of value creation but within our data we found indication for the different modes of value co-creation (Suprateek Sarker et al., 2012; Huntgeburth et al., 2015). Second, it has been emphasized that feedback mechanisms with customers as well as market observation is necessary to improve the platform and meet customer requirements. These absorptive capacities (Venkatraman and Pavlou, 2014) may provide an additional mechanism which provide timelier signals to reconsider the strategic intent or business model implementation than monitoring market performance. Third, it appeared that partner management capabilities – not only bound to IT – are found to be highly relevant. These activities include business development and marketing strategies, which have therefore only partly been captured within the dyadic IT customization activities. Fourth, subject to network IT standardization, modularization has been highlighted; nonetheless, different levels of modularization (e.g. inter- or intra-platform) may play a different role in value creation and value appropriation. For example, if in the case of complementary generation or innovation development newly created services can be included in other solutions and thereby extend the platform, it is different from using APIs to utilize added-value-services of the platform provider. This is in line with our finding that novel sales channels are often a source of value creation for these newly created services or complementarities.

5 Summary and Outlook

To address the research question how Cloud platforms create and appropriate value and which IT capabilities they require, we built on four case studies. Based on these, four instantiations of dominant strategic intents (improve market responsiveness, develop innovative services, develop market und customer relationships, generate complementarities) were identified. These strategic intents each generated business model requirements in the context of cloud platforms prevalent in our empirical data. Furthermore, these drive the development of unique B2B IT capabilities of such platform providers, which then enable value creation and appropriation mechanisms. In particular, we propose three dyadic IT customization and two network IT standardization capabilities based on our cross case analysis. We found that all three value creation mechanisms (novelty, efficiency, complementarity) were prevalent in almost each case (except Delta (novelty)). In terms of value appropriation, bundling is the prevalent mechanism combined with other strategies. We suggest two additional mechanisms: downstream capabilities (billable consulting and support) and platform resourcing (increase in scope and reach of the platform by integrating complements). In summary, we propose that capabilities are intended to leverage solutions and services that are then multiplied in order to create value. Value appropriation mechanisms are designed that rents grow with the success of these and to occur repeatedly.

We believe our contribution is twofold. First, we show the validity of the framework of Rai and Tang (2014) by the instantiation with our empirical case data. Second, we advance the field of business models of Cloud platform ecosystems by extending (value appropriation) and bridging (BM implementation through IT capabilities) previous work in this domain. We believe that by providing rich empirical examples, we help to advance the understanding of business models, necessary capabilities as well as value creation and appropriation mechanisms of Cloud platforms. Based on our gained insights, we provide indicators for further research in order to strengthen the understanding of value creation mechanics in this context. The instantiated framework helps to understand the underlying logic and mechanisms of Cloud platform business models in terms of strategic intents, derived business model requirements and necessary capabilities to create and appropriate value. Eventually this may help fellow researchers to explore this phenomenon in more detail. In particular, we propose to extend the empirical database in order to overcome the limitations of this study, i.e. finding cases for the missing strategic intent (supply chain efficiency), develop further ideas in terms of similarities and differences for B2B capabilities. Furthermore, we think it is worthwhile to explore the other phenomena that serve as the theoretical boundaries in order to create a more robust framework in the context of Cloud platform ecosystems and other IT-enabled business models.

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