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Analyzing Dynamic Capabilities in the Context of Cloud Platform Ecosystems - A Case Study Approach

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Abstract

Dynamic capabilities (DCs) refer to a firm's abilities to continuously adapt its resource base in order to respond to changes in its external environment. The capability to change dynamically is crucial in business ecosystems that are composed of a variety of actors.

Amazon Web Services (AWS), the leader in the cloud platform industry, is a promising cloud platform provider (CPP) to show a high degree of dynamic capability fulfillment within its highly fluctuating ecosystem. To date, the full scope of dynamic capabilities in cloud platform ecosystems (CPEs) has not been fully understood. Previous work has failed to deliver a combined perspective of explicit dynamic capabilities in cloud platform ecosystems applied on an in-depth practical case.

With our mixed-method case study on the AWS ecosystem we deliver a thorough understanding of its sensing, seizing and transforming capabilities. We generate a set of strategy management frameworks that support our expectations, lead to unexpected insights and answer the questions of what, how, why and with whom AWS uses DCs. In detail, we provide an understanding about DC chronological change, DC network patterns and DC logical explanations. Our research is based on a self-compiled case study database containing 16k+ secondary data pages from interviews, blogs, announcements, case studies, job vacancies, etc. that we analyze qualitatively and quantitatively. We find out that AWS develops and holds a large set of interacting dynamic capabilities incorporating a variety of ecosystem actors in order to sustain tremendous customer value and satisfaction.

The thesis infers significant theoretical and practical implications for all CPE actors, like partners, customers, investors and researchers in the field of IT strategy management. Managers of all CPE actors are encouraged to critically evaluate their own maturity level and complement a CPP's DC explications in order to boost business by implementing sensing, seizing, transforming and innovating capabilities.

Keywords: Dynamic Capabilities, Cloud Platform Ecosystems, Innovation Capabilities, Mixed-Methods Case Study, Amazon Web Services

1. Introduction

[1]In this first introductory chapter we justify the ground of our investigation and set the topological frame for the research. It is organized as follows: We (1) present the motivation and problem area for the work ahead, (2) review related work that lead us to (3) research questions. Lastly, we (4) outline the structure of this thesis.

1.1. Motivation and problem area

In today's modern digital society platforms are pervasive and support human life in manifold ways if not just even enable the digital aspect. A platform in this way is an intermediate, a tool or a place to be interconnected with a wider social group or computers in order to innovate and consume, produce and exchange. Famous and historical examples such as

- operating systems (Microsoft Windows, Linux OS),
- microprocessors (Intel, ARM),
- digital distribution services (iTunes, Apple App Store, Google Play),
- social networking sites (Facebook, Twitter, LinkedIn),

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- videogame consoles (Sony PlayStation, Microsoft Xbox) and
- payment technologies (PayPal, Visa)

show that platform offerings can advance to the most diverse areas of modern living (Gawer and Cusumano (2014)).

This importance of platforms can be captured in models of value creation and value appropriation (Jacobides et al. (2006)). The economic value is justified by a study of Hidding et al. that shows that 3/5 of the largest companies in this world make more than half of their revenues through platform markets (Hidding et al. (2011)).

Innovation today is not purely done by single individuals, more innovative services and products have their origins in the minds of many different actors - especially in high tech industries, such as information and communications technology (ICT) industry (Gawer and Cusumano (2002)).

A steadily growing ICT driver are cloud computing platforms (cloud platforms). Those are the cause for a huge amount of important innovative business models and disruptive innovator for manifold industries, e.g. internet of things (IoT), sharing economy, media and entertainment, gaming and retail (Marston et al. (2011)).

Managing the complexity of cloud platforms is enormously difficult because of the usually tremendous growth, dynamic environmental changes and variety of actors in the created ecosystem landscape (Cai et al. (2009)).

A vast amount of researchers have tackled platform management research topics, such as platform organization (Venkatraman and Lee (2004); Kapoor and Lee (2013)), platform architectures (Langlois and Robertson (1992)), platform strategies (Almirall and Casadesus-Masanell (2010)) and platform leadership (Gawer and Cusumano (2002)). Not only cloud platforms are important. Moreover, theory and management practice has identified the business ecosystem around CPP as enormously important. For the success of a technology system platform the proper management of the surrounding ecosystem is essential (Gawer and Cusumano (2002)).

These business ecosystems consists of a variety of actors, like customers, developers, researchers, complementors and investors (Teece (1986); Shapiro and Varian (1999); Iansiti and Levien (2004); Tiwana (2013)).

Another crucial aspect of cloud platform ecosystems is their volatility. As technology and consumers change over time, intelligent identification and response abilities are necessary to gain competitive advantages. These managerial and strategic responses to environmental changes can be summarized as dynamic capabilities. The development and management of dynamic capabilities is highly complex and important for companies' success in dynamic environments (Teece (2007); Eisenhardt and Martin (2000)).

Also professional service firms have specialized in the consulting of dynamic capabilities. This confirms the importance of this research topic for a broad set of industry managers in practice (Michel (2015)). A cloud platform's success is strongly connected with its dynamic capabilities. Nonetheless, those are not thoroughly understand up to date (Thomas et al. (2014)).

1.2. Related work

Although there has been a vast amount of research in the area of (cloud) platforms (Sun et al. (2015)) and dynamic capabilities (Barreto (2009); Eriksson (2013)) few research has been done on dynamic capabilities in the context of platforms and ecosystems but can be seen broadly as related work (Isckia et al. (2009); Salazar (2012); Tsai (2013); Thomas et al. (2014); Venkatraman et al. (2014)). Thus, the focus of recent research has been a broader view on dynamic capabilities in platform ecosystems.

In an early work by Isckia & Lescop AWS's open innovation strategy (as one explication of dynamic capabilities (Teece (2007)) was examined in a case study approach in order to comprehend the technical and organizational leverage based on web services (Isckia et al. (2009)). Salazar indicates from a case study that ARM's (microelectronics manufacturer) success is truly based on its dynamic capabilitites within a larger platform ecosystem (Salazar (2012)). A framework by Tsai proposes a variety of strategic movements that can be performed by platform owners in dynamic platform surroundings in order to gain future competitive advantage. His research is based on a cross-case analysis (Tsai, 2013). The results offered by Thomas et al. suggest that architectural leverage creates platform value and success. This is accompanied by IP protection, platform control and leadership and trend following (some explications of dynamic capabilities (Teece (2007); Thomas et al., 2014)). Venkatraman et al. developed a series of concepts showing the characteristics of digital business innovation platforms while being dynamic capabilities one dimension to deliver potential value created by the platform characteristics (Venkatraman et al. (2014)).

1.3. Research questions

What is not understood well is what specific dynamic capabilities (DCs) cloud platform providers (CPPs) use in their ecosystems, especially how, why and with whom. Up to this point we define the following broad research questions:

- RQ1: What specific dynamic capabilities do CPPs use within their ecosystem?
- RQ2: Why do CPPs use dynamic capabilities?
- RQ3: How do CPPs use dynamic capabilities?
- RQ4: With whom do CPPs use dynamic capabilities?
- RQ5: What outcomes caused by strategic responses of CPPs that are based on dynamic capabilities can be identified?

1.4. Thesis structure

We elaborate a set of answers to our research questions in a four-step-methodological concept that is shown in Figure 1 (research design inspired by (Van de Ven (2007)). Part I helps to refine the previously stated research questions. Firstly, a thorough literature review leads us to a series of conceptual frameworks. Furthermore, we sketch our expectations. Consequently, Part II will discover the methodological standards in this research field. Specifically, we introduce our research design and tools, as well as how our mixed-methods research design is overlaid on top. Part III can be classified as the core of this work where we apply our research methodology on the case of Amazon Web Services (AWS). After a short introduction of AWS we expose the data preparation, collection and conversion processes as well as apply analytic techniques in order to gather valuable insights about the answers to our research questions. The results are condensed in conceptual frameworks. Finally, we discuss the implications on theory and practice in Part IV. Even if we cannot fully generalize the insights of the case study, lessons can be drawn about dynamic capabilities in the context of cloud platform ecosystems.

2. Part I: Literature review

In this chapter we compose a literature review that should introduce unexperienced readers quickly into the topic, reveal state-of-the-art research insights and generate conceptual frameworks for the refinements of previously defined research questions.

After a short methodological justification, we first expose a general theoretical background introducing the topics of cloud computing, platform management, ecosystem theory and strategy management. After this, we develop coherent conceptual frameworks based on recent literature about a) dynamic capabilities (DCs), b) cloud platform ecosystems (CPEs), c) dynamic capabilities in the context of platforms (DCs in CPEs) and d) a specification of the previously stated research questions. We compare the typologies of each domain that will help us to define mutually exclusive and collectively exhaustive code schemes. Lastly, we state our expectations.

In this initial phase of investigation we make use of conceptual frameworks in order to guide the research. As we address a qualitative research problem, we create conceptual frameworks inductively after synthesizing and integrating existing models. Later, we compare previous research outcomes with the case of AWS to ensure that we identify discrepancies and define our research contribution (Imenda (2014)).

2.1. Theoretical background

We present the fundamentals of cloud computing and platforms, as well as ecosystem theory and origins of dynamic capabilities. Since a comprehensive symbiosis of these topics has not been addressed before, we consider each topic separately.

2.1.1. Cloud computing and platforms

Cloud computing and platforms have emerged during the last years extensively (Qian et al. (2009)). Much is known about specific technical specification (Furht and Escalante (2010)) and business models (Strømmen-Bakhtiar and Razavi (2011)). But less is known about organizational and managerial aspects of complex cloud platforms and companies that respond to enormously dynamic environment. What about the strategies, organization, governance and innovation?

Cloud computing platforms

When we talk about cloud platforms we always mean cloud computing services that cover the whole set of "as-a-service"-models, including, software, platforms and infrastructure. As stated by Landis and Blacharski (2013) "cloud platforms are offered 'as a service', [...] taking advantage of underlying cloud infrastructure, elasticity and as-a- service models". The corresponding advantages are manifold, e.g. lower costs and risks and faster time-to-market by use of rapid prototyping (Landis and Blacharski (2013)).

Buyya et al. (2008) compares a set of cloud platforms. They name examples as Amazon's Elastic Compute Cloud (infrastructure) and Google's App Engine (platform) (Buyya et al. (2008)). Cusumano (2010) focuses on SaaS platforms as platform mode and shows examples such as Microsoft Azure, Google App Engine and Amazon EC2 (Cusumano (2010)).

Cloud computing deployment models

Cloud deployment models determine the degree of openness of a cloud infrastructure. A public cloud is accessible to the general public. A private cloud is provisioned for an exclusive user group only. At last a hybrid cloud is an aggregation of singular private/public cloud infrastructure (Mell et al. (2011)).

Cloud computing definition

Cloud computing is a characterized as a service model delivering network-based access to a variety of computing resources that are configurable, e.g. servers with computing power, storage, networks, applications and services. This means that services do not need to be established, installed, configured and run on a local machine, but rather on remote machines usually accessible through the internet. Those services generally have a set of features that are highly desirable for the optimization of IT architectures and business models. The National Institute of Standards and Technology (NIST) categorizes the features as follows:

- "On-demand self-service": Customers can make use of the services instantly and without provider intervention.
- "Broad network access": Services can be utilized through a broad network (e.g. internet), through standard interfaces. Furthermore, the integration of heterogeneous systems and platforms is provided.
- "Resource pooling": The provider aggregates various

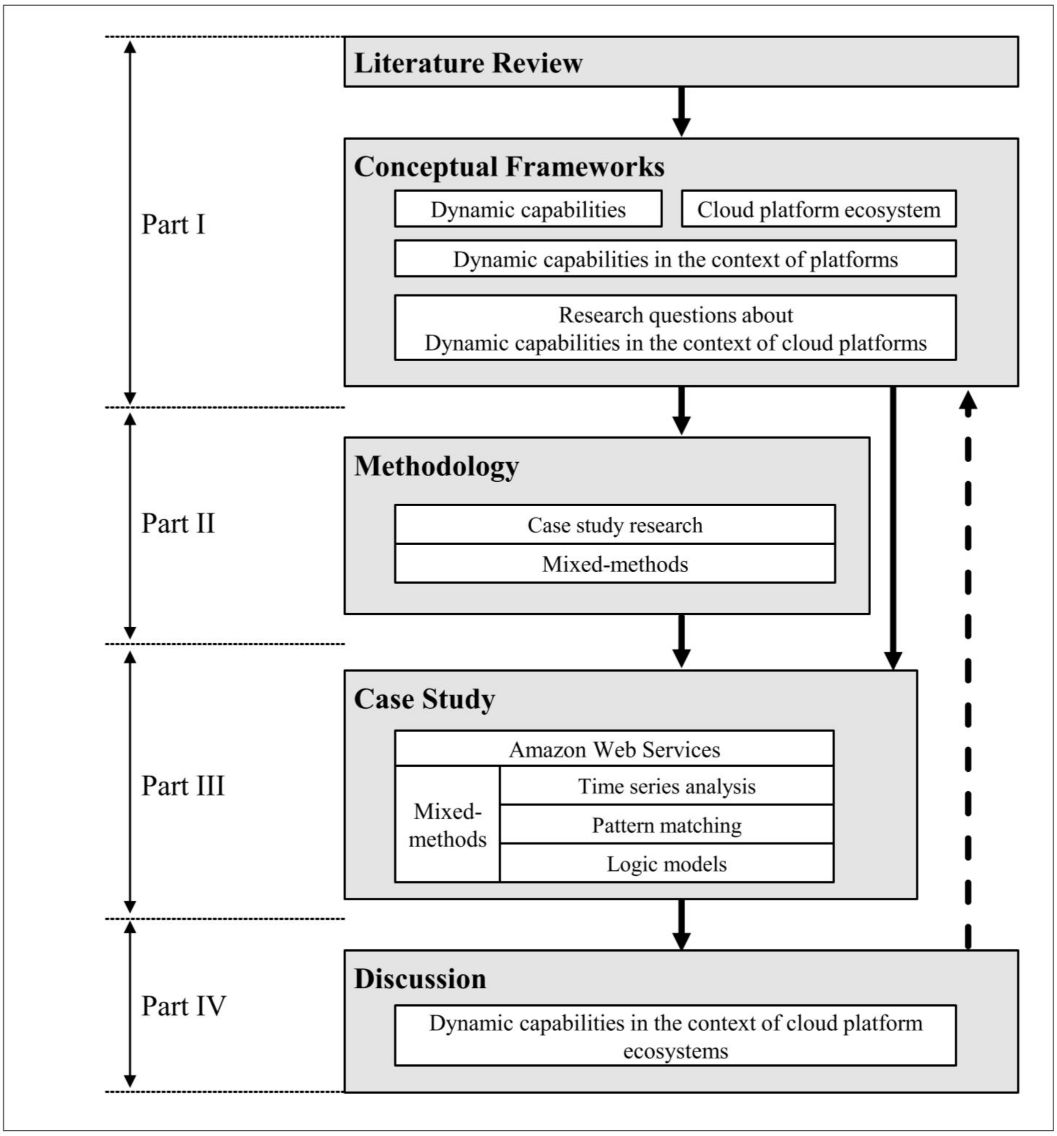

Figure 1: Thesis structure

resources (e.g. CPU time, storage) physically and virtually to allocate capacities to several customers.

- Rapid elasticity": The provision of resources can scale out or up at any time, thus also automatically adapt to changing demand.
- "Measured service": A measuring service is offered to supply proper measuring, monitoring, steering and reporting functions (Mell et al. (2011)).

Cloud computing services models
A range of service models specify the extensive cloud computing offering. The NIST defined three services models that can be imagined as a stack going from Software-as-a- Service (SaaS) over Platform-as-a-Service (PaaS) to Infrastructure-as-a-Service (SaaS). To distinguish those we give a definition of each.

- SaaS: Consumers access cloud applications of the provider through a web interface in order to use software without managing any applications, platforms or infrastructure.
- PaaS: Consumers access cloud platforms of the provider through a web interface in order to acquire, program and configure applications without managing any platforms or infrastructure. The provider offers the means of managing the applications on a platform.
- IaaS: Consumers access cloud infrastructure of the provider through a web interface in order to set up deployments, operating systems, security mechanisms etc. without managing the infrastructure (Mell et al. (2011)).

2.1.2. Platform management

Platform definition
According to Tiwana: "A software platform is a software-based product or service that serves as a foundation on which outside parties can build complementary products or services. A software platform is therefore an extensible software-based system that provides the core functionality shared by “apps” that interoperate with it, and the interfaces through which they interoperate." This definition highlights the important role of complementors (Tiwana (2013)).

Platform strategies
Since platforms are highly dependent on its surrounding ecosystem mechanisms, managing this is of highly strategic importance. This is highlighted by the degree to which the platform owner opens up its technology and business, as well as direct activities to oversee complementors and the market.

The degree of openness of a platform in all its attributes outlines the innovation extent and is concisely managed by platform owners. Platform openness defines the willingness and execution of platform owners to make platform technology available to external complementors, such as innovators and partners. Furthermore, platform openness includes all ambitions to effectively cut all applied technology barriers, whether they are due to access, utilization and commercialization or value appropriation (Schilling (2009); West (2003);Boudreau (2010)). A few measures have been investigated that indicate platform openness, such as platform control, ownership, integration, contributions, access, complementarity and intellectual property. Studies show that the degree of openness has high impact on the innovativeness of the entire platform ecosystem (Boudreau (2010)).

The concept of open innovation spans the idea of opening technology and business capabilities to outside actors in order to generate external ideas and knowledge. Additionally, it serves as a mean of boosting up innovations around (and inside) technology platforms with the goal of generating value-added services and products. As a result the innovation potential increases and implies a valuable strategic tool. Based on this we distinguish three different concepts. In case of outbound innovation, the platform owner sets free assets (knowledge, invention, etc.) to externs. This can be done via free revealing or selling assets. With inbound innovation activities the platform owner gathers assets, either it is freely sourced or acquired. As a third the mixed innovation approach means that partly assets are set free but at the same time assets are gathered (Chesbrough (2006); Dahlander and Gann (2010)).

The degree of platform openness is strictly related to the activities to protect intellectual property (IP), i.e. technology licensing. Platform systems that pursue a strong openness protect IP differently than closed systems. Such open projects are based on public licenses, such as GNU GPL. By opening up the platform control and ownership is by far waived and passed to complementors and other ecosystem actors. For proper value appropriation technology licensing is a common mean. Also hybrid strategies are common which open up specific portions of a platform and place the platform technology in the public more restrictively (Teece (1986); Rey and Salant (2012); (**?**; Schilling et al., 2009; Simcoe et al. (2009); West (2003)).

We can distinguish two different modes that reveal the direction to which the openness is led. A vertical openness strategy directly concerns complementors. This can be measured by the extent to which complementors are incorporated into the platform, access is allowed to others and backward compatibility to former platform generations and services is ensured. A horizontal openness strategy affects cooperation with competing platforms, i.e. the extent to which platform systems are interoperable, licensed and jointly developed (Eisenmann et al. (2008)).

Specifying the certain degree of platform openness has valuable effects on the complementary innovativeness of the entire platform ecosystem. There is a strong trade- off between an open platform strategy that leads to value adoption and a closed (proprietary) platform strategy that results in more value appropriation (Economides and Katsamakas (2006); Almirall and Casadesus-Masanell (2010);Boudreau (2010); Gawer and Cusumano (2014); Eisenmann et al. (2008); Schilling (2009); West (2003)). A strictly open strategy leads to slower cost amortization speed and thus lower intensity of appropriate returns because of no barriers to entry and imitation. The conditions for beneficial innovativeness are a strong external network and means for co-specialization. One the other hand, a strong closed platform strategy leads to fastest cost amortization and highest return appropriation. Because of high IP protection the barriers to entry and imitation are high. Competitive advantages in service or products are essential for this strategy type (West (2003); Schilling et al., 2009).

We once more highlight that the openness is highly important to encourage the external environment to develop complements. The successful establishment and orchestration of the entire ecosystem leads to higher scale, scope and speed of complementary innovation (Gawer and Cusumano (2014); Venkatraman et al. (2014)). Furthermore, hybrid platform approaches enable complementors that even have not been imagined by the platform provider (West (2003)). Studies have shown that the optimal degree of openness is a hybrid approach with more or less limited licensing policies. This is based on an inverted-U correlation between accessibility and complementary innovation (**?**). To a certain point more IP licenses lead to a more diverse product and service portfolio (Rey & Salant, 2012).

Depending on the degree of platform openness the platform leadership role becomes more and more important. Furthermore, wise strategic choices have to be made as a platform provider whether to collaborate and/or compete with complementors.

Platform leadership is characterized as successful ecosystem management and proper technical service and product engineering. Essential for a successful management of the ecosystem are (1) occupying a visionary product/service role in an ecosystem (2) encouraging complementors to share the vision and co-create products/services, (3) dominating the platform as a central part and (4) provoking the growth of the platform. Enhancing the (architectural) connectivity and appropriability of the platform supports a systematic service and product engineering (Gawer and Cusumano (2014); Gawer and Cusumano (2002); Gawer and Cusumano (2008)).

The configuration of competitive and cooperative relationships another important strategic aspects that needs to be investigated in order to encourage complementary innovation. Those relationships can appear between all possible actors of a platform ecosystem (Economides and Katsamakas (2006); Gawer and Cusumano (2002)); Shapiro and Varian (1999)); Casadesus-Masanell and Yoffie (2007); Parker and Alstyne (2008); Hagiu (2009b)). A few measures indicate a rather competitive environment: (1) developing own platform complements, (2) acquiring complementor companies, (3) entering complementor markets (Gawer and Cusumano (2002)) and (4) pricing the platform components aggressively (Economides and Katsamakas (2006)).

Further important concepts of platform management

Other important platform management concepts include platform architectures (modularity, technical boundaries as resources), platform organizations (internal and interfirm organization) and platform governance (decision rights, pricing and control portfolio) (Tiwana (2013)).

Further important concepts of cloud platform management

Specifically, for cloud platform ecosystems management decisions refer to modes of innovation (whether architectural, radical, increment or modular), platform governance (autonomy, integration, pricing) and modularization (decoupling, interface standardization) (Tiwana (2013)).

2.1.3. Ecosystem theory

Originally, platforms evolved from the concept of business ecosystems, where innovation happens because companies and other actors acquire capabilities in order to develop new services and products directly based on customers' needs (Moore (1996)). Complementary innovation is promoted among a variety of stakeholders that are organized in structures and alliances with specific relationships (Kapoor and Lee (2013); Venkatraman and Lee (2004)). On top of those ecosystems 'ecosystem leaders' serve as central points to allow some verticality (Gawer and Cusumano (2002)).

One of the most valuable and interesting effects in business ecosystems is the network effect. Once the number of users of an ecosystem grows the value of that service or product increases (Iansiti and Levien (2004)). Those network effects is it what makes cloud platform ecosystems so interesting, as with modern internet technology (i.e. web services) the barrier to interconnect diminishes to a minimum. A variety of actors surround the cloud platform provider, e.g. independent service providers, partners and customers (Huntgeburth et al. (2015)).

Especially, the cloud platform ecosystems are characterized as multisided platforms, where two sides interact directly with each other, but use the platform as an intermediary. Thus they also have a relationship with the platform. An example would be if a private user watches a movie on Netflix that is built on top of AWS. The user has a direct relationship with Netflix (payment, service) and an indirect one with AWS (data streaming), whereas Netflix pays AWS and builds its services on its infrastructure (Hagiu (2014)).

A combined view on the current understanding of value co-creation and value networks in cloud ecosystems (Figure 2) shows that there are usually three relations that can occur between cloud platform providers and other ecosystem actors: exchange, integration and addition of resources, application services, consulting services, data and money. Cloud ecosystem actors exchange know-how, accumulate trends and use computing capacities. They can integrate knowledge and services in order to innovate and secure intellectual property. Complementary services can help to orchestrate services and deliver additional value to customers (Huntgeburth et al. (2015); Leimeister et al. (2010)).

2.1.4. Origins of dynamic capabilities

The research field of dynamic capabilities has its origin in the theoretical research field of strategic management. The theoretical foundation is grounded in the fields of resource-based view and evolutionary economics (Di Stefano et al. (2010)). The resource-based view lays out that a firm's performance in relation to competitors is based on its ability to bundle and manage its resources to the best extent (Wernerfelt (1984)). Those resources should be valuable, rare, inimitable and non-substitutable (VRIN) (Crook et al. (2008)). The idea of evolutionary economics focuses on the analogy to transfer the idea of biological evolution to economics, so that technological change and innovation build central methods for service and product variation and leads to the 'survival of the fittest' (Nelson and Winter (1982)).

2.2. Cloud platform ecosystems

As already mentioned before the specific actors probably play important roles while analyzing the dynamic capabilities of CPEs. For further investigation it is essential to have an accurate understanding of the various different actors. Thus, we compile the most important literature of actors in cloud platform ecosystems and synthesize them. With the help of a matrix and concise comparison we guarantee a high level of detail as well as generalizability. In addition to that we want to create an agreement and confirmation by previous work (Table 1) to have a valid overview (Figure 3).

The papers by Mayevsky and Tsujimoto et al. can be seen as the leading CPE actor network-defining work to date. Mayevsky rather concentrated to deliver a detailed view focusing on a variety of cloud service support providers (like cloud auditors, cloud architects, cloud integrators, cloud software vendors and cloud hardware vendors) and cloud service brokerage (service aggregators, resellers and consultancies) (Mayevsky (2014)). Contrary, Tsujimoto et al. delivered a much more generalized and thus broader framework

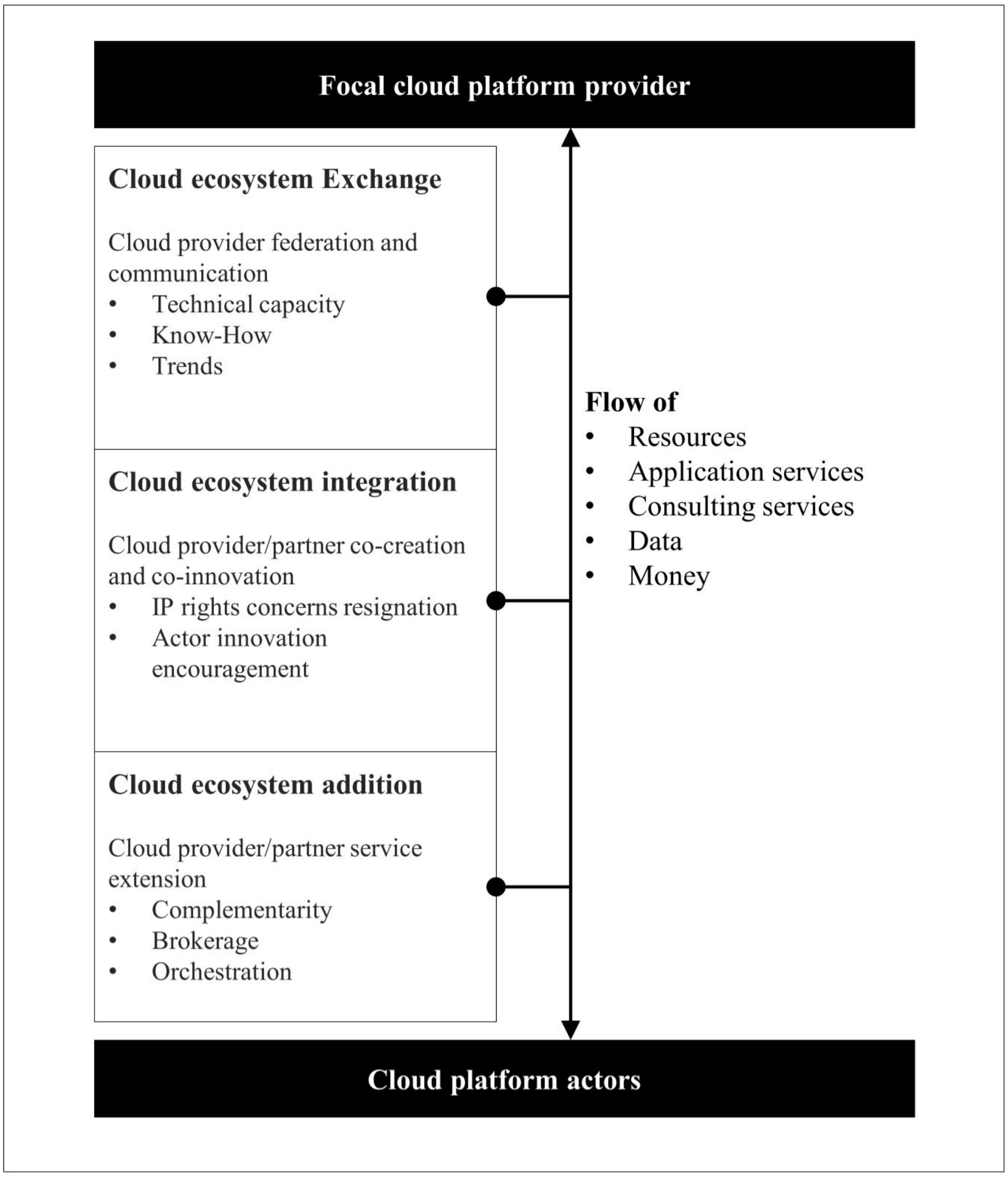

Figure 2: Cloud platform ecosystems theory (following (Leimeister et al. (2010); Huntgeburth et al. (2015))

where they also integrate suppliers, outside innovators (like research institutes), entrepreneurs (like investors) and competitors but lack in detail. By this, suppliers can be seen as cloud hardware vendors (Tsujimoto et al. (2015)). Further research about cloud platform ecosystems confirms the work of the former two papers (Leimeister et al. (2010); Martens et al. (2011); Porch et al. (2015)).

Level I summarizes cloud recipients. Among those we see private actors, business actors, state officials and local government as well as IT residents (Level II). Additionally, we also include all connected communities. We count developers and IT organizations (Level III) to IT residents. We define cloud recipients in general, as actors that directly consume cloud services.

The large level I group are all members of the cloud partner ecosystem. A smaller ecosystem within the larger cloud platform ecosystem that consists of cloud platform provider and complementors (partners) (Level II). The cloud platform provider are separated into Software-as-a-Service, Platform-as-a-Service and Infrastructure-as-a- Service companies (Level III). But a differentiation here is not strict at all. Some CPPs can even offer the whole set of -aaS's. We define CPPs as companies that directly offer cloud services to customers and consumers. Complementors such as cloud service support providers (deliver technical service support and complementarities) and cloud service brokerages (deliver non-technical service support, usually sales) (Level III) can even be further subdivided into level IV actors. Further level

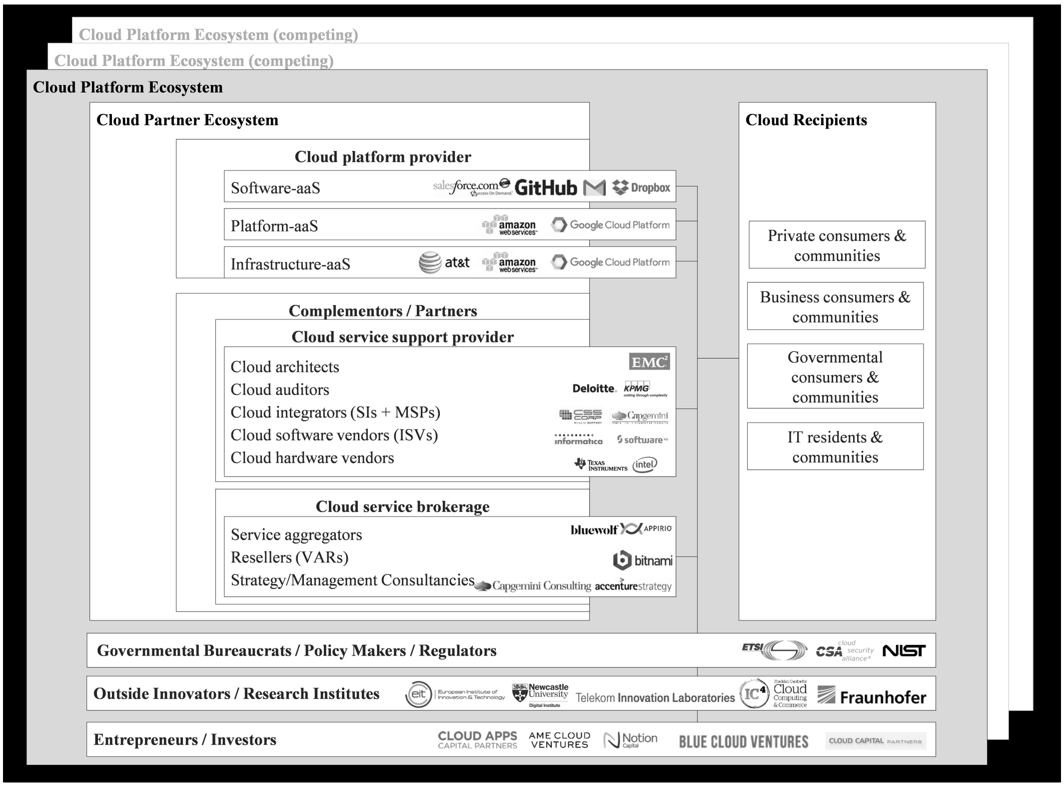

Figure 3: Framework 1: Cloud platform ecosystem actors (following a synthesis of (Mayevski, 2014) and (Tsujimoto et al., 2015))

I actors identified are governmental agencies (regulators, policy makers, bureaucrats), outside innovators (research institutes), entrepreneurs (investors) and competitors.

2.2.1. Framework 1: Cloud platform ecosystem actors

With the help of the former investigation we can accumulate a combined view of actors in cloud platform ecosystems (Figure 3). We also attached some examples as logos with website links in the appendix B1 for interested readers. The focus here clearly lies in the depth of the cloud partner ecosystem where we reach a fourth level of cloud platform ecosystem actors. The boundaries inside cloud platform providers are usually not very strict as they become blurred. For example AWS at the first sight seems to be more an IaaS-provider but also has clearly some PaaS if not even SaaS elements combined in their offering. We also cover the width of the various ecosystem actors. We do this by incorporating also more external actors like regulators, innovators and research institutions. Note that we can also distinguish between various cloud recipients. Beside classic private and business consumers we also incorporate IT residents, such as developers.

2.3. Dynamic capabilities

2.3.1. Introduction

Dynamic capabilities is a construct that describes "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al. (1997)). The research agenda for dynamic capabilities is very comprehensive. A lot of reviews show high evidence for vast research in the past (Cavusgil et al. (2007); Wang and Ahmed (2007); Easterby-Smith et al. (2009); Barreto (2009)). Up to this point there is no clear understanding about what typologies comprise dynamic capabilities. Also, here we identify the need for a comprised framework that covers depth and width of this topic, preferably a framework with subdomains representing analyzable dynamic capabilities.

2.3.2. Synthesis of 'Dynamic capability'-typologies

Mapping dynamic capabilities typologies

We want to draft the dynamic capability surroundings. Thus we build a value chain that reflects dynamic capability-typologies, is based on a literature review and helps us to identify possibly overlapping schemes. Davis et al. analyzed the environmental dynamism around companies that is composed of velocity, complexity, ambiguity and unpredictability (Davis et al. (2009)). This dynamism can be investigated further leading us to hyper environments for the use of regenerative DCs, dynamic environments for renewing DCs and stable environments for incremental DCs (Ambrosini and Bowman (2009)). Wang et al. identifies features of dynamic capabilities that were analyzed more by Salazar, leading to adaptive, absorptive and innovative capabilities (Wang and Ahmed (2007); Salazar (2012)). Eisenhardt

Table 1: Synthesis of 'cloud platform ecosystem actor'-typologies

From this work we deduce four levels of cloud platform ecosystem actors (Table 1).

Cloud platform ecosystem actors Level I	Level II	Level III	Level IV	Typology Mayevsky, 2014	Tsujimoto et al., 2015	Leimeister et al., 2010	Porch et al., 2015	Martens et al., 2011
Cloud recipients				x	x	x	x	x
	Private actors and communities			x	x	x	x	
	Business actors and communities			x	x	x	x	x
	Officials, state and local government			x				
	IT residents and communities							x
		Developers		x				
		IT organizations		x				
Cloud partner ecosystem				x	x	x	x	x
	Cloud platform provider			x	x	x	x	x
		Software-aaS			x			x
		Platform-aaS		x	x	x		x
		Infrastructure-aaS		x	x			x
	Complementors/ Partners			x		x	x	
		Cloud service support provider		x		x		
			Cloud architects	x				
			Cloud auditors	x				
			Cloud integrators (Sis + MSPs)	x		x		
			Cloud software vendors (ISVs)	x				
			Cloud hardware vendors	x				
		Cloud service brokerage				x		
			Service aggregators	x		x		
			Resellers (VARs)	x				
			Strategy/ Management consultancies	x		x		
Governmental bureaucrats / Policy Makers / Regulators				x	x			x
Outside innovators / Research institutes					x			
Entrepreneurs / Investors					x			
Competitors					x		x	

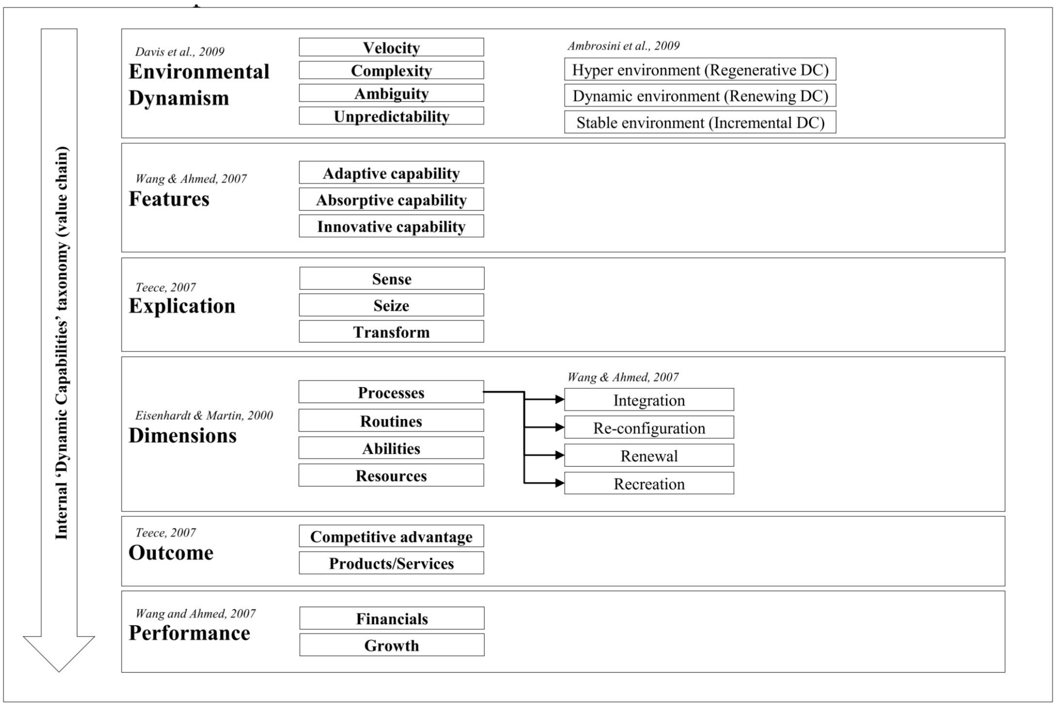

Figure 4: 'Dynamic capabilities'-typologies

and Martin explored the dimensions of dynamic capabilities, such as processes, routines, abilities and resources, whereby Wang and Ahmed investigated this further into integration, re-configuration, renewal and recreation processes (Eisenhardt and Martin (2000)). Outcomes such as competitive advantages, products and services ultimately lead to good financials and general company growth (Wang and Ahmed (2007)).

Again dynamic capabilities directly affect the resource base, such as business development, research, development & innovation, knowledge, culture, human capital and governance (Wernerfelt (1984)).

Figure 4 shows the typology overview so far. It reveals that enterprises are confronted with environmental dynamism. Various different dynamic capability features, explications and dimensions reform the resource base and lead to better outcomes and performance.

Teece's Dynamic Capabilities

First, we analyze the most cited typology of dynamic capabilities (Teece et al. (1997)) (cited by 25.700 on 4.9.2016) that covers the aimed width and depth to good extent. Dynamic capabilities by Teece are defined as "sensing", "seizing" and "transforming" processes that ultimately lead to broad dynamic capabilities. Those are divided into three levels. Whereas the level-I DCs comprise the sensing, seizing and transforming processes, level-II DCs explain the microfoundations of DCs. Figure 5 illustrates the deduced relationship. Teece describes sensing capabilities as processes that are aimed towards analytical systems that identify and exploit opportunities. Those could originate in external or internal structures that are comprised out of a lot of ecosystem actors. Seizing capabilities are procedures that should define and reshape the business model based on the prior investigated opportunities. Here the notion of open innovation becomes important too as the platform boundaries maybe realigned. Lastly, transforming capabilities focus on proper knowledge management, the building of governance structures and cospecialization procedures.

Because Teece's dynamic capability typology is well understood and accepted we already include those into our codebook. We adapt the Teece's structure on level-II for better mutual exclusivity. Furthermore, we add a third level (level-III) that covers the dynamic capability explications. Later we compare other schemes with Teece's original schema to verify this possibly sound and comprehensive typology. The following tables show our dynamic capability level scheme as well as the assigned DC codes. Sensing capabilities (Table 2) describe the abilities to identify, target, select and exploit research and development activities. Further, it leads to selections and analyses of the environment, with it all actors the company holds relationships with. Seizing capabilities (Table 3) represent the capability to redesign the business model, select decision making processes, building loyalty and commitment processes as well as selecting the enterprise boundaries for platform and complementor management. Transforming capabilities (Table 4) relate to the knowledge management and co- specialization abilities. Furthermore, they reflect how open innovation, modularity and governance is strengthened (Teece (2007); Wang and Ahmed (2007); Salazar (2012)).

Wang & Ahmed's dynamic capability explications represent adaptive capabilities (identifying, focusing and balanc-

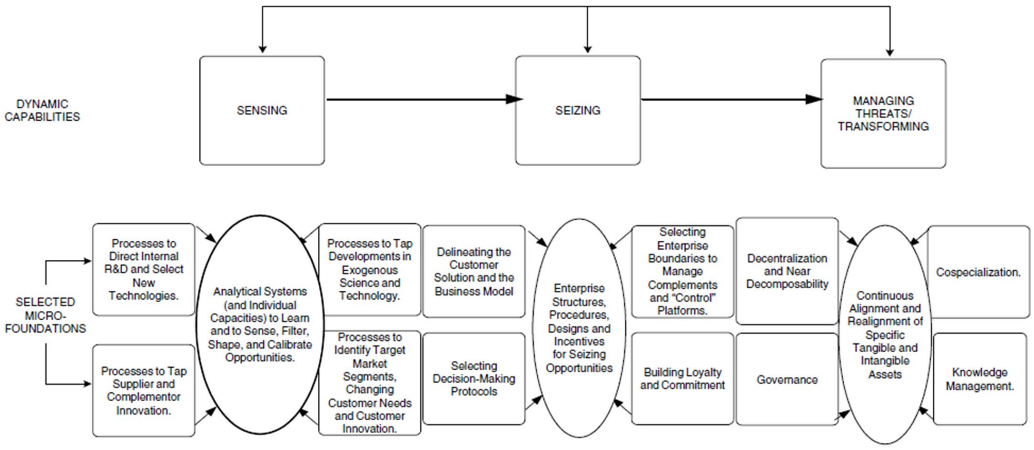

Figure 5: Dynamic capability microfoundations (Teece (2007))

Table 2: Dynamic capability explications - "Sense" (following Teece (2007))

Dynamic Capability (Level-I)	Dynamic Capability (Level-II)	Dynamic Capability (Level-III)	DC Code
Sense	Identify, target, select and exploit innovation, research and development	Sensing external innovation	Sense 1
		Sensing and directing internal innovation	Sense 2
		Encouraging open innovation focused on a broad external base	Sense 3
		Sensing external R&D	Sense 4
		Sensing and directing internal R&D	Sense 5
	Analyze and select the environment	Identifying market segments	Sense 6
		Identifying changing customer needs	Sense 7
		Identifying and evaluating ecosystem and industry trends	Sense 8
		Using analytic frameworks to sense opportunities and threats	Sense 9

ing market opportunities), absorptive capabilities (evaluating and utilizing external and internal knowledge) and innovative capabilities (realigning the business model) (Wang and Ahmed (2007)). We neglect other DC-related work that does not show any tangible results that could enhance the width or depth of our typology, e.g. (Ridder (2011) about outside-in/inside- out sensing and inward/outward seizing).

Contentual comparison

We identify a potential overlap from the typologies of Teece and Wang & Ahmed. A nearer look confirms this expectation. In Wang & Ahmed's dynamic capability typology sensing is declared as adaptive DCs and transforming is declared as absorptive DCs. Thus, we can exclude Wang & Ahmed's investigation from our framework.

2.3.3. External and internal view

Another important aspect we want to reinforce explicitly is the external view that needs to be incorporated directly when we investigate dynamic capabilities further. Complexity and uncertainty caused by external actors could directly and indirectly impact the focal firm. Figure 6 reveals this focus (Ambrosini and Bowman (2009)).

2.3.4. Framework 2: Dynamic capabilities

From this investigation so far we can create a framework (Figure 7) that separates the internal from the external view, includes Teece's dynamic capabilities (all levels) and lead to outcomes in the form of competitive advantage and performance.

2.4. Dynamic capabilities in the context of platforms

2.4.1. Synthesis of 'Dynamic capabilities in the context of platforms'-typologies

Mapping dynamic capabilities in the context of platforms

Dynamic capabilities also have been analyzed very roughly in the context of platforms. Salazar identified and analyzed three forms of dynamic capabilities that occur in platform ecosystems: learning, architectural and strategic capabilities. Learning capabilities comprise the management of tacit

Table 3: Dynamic capability explications - "Seize" (following Teece (2007))

Dynamic Capability (Level-I)	Dynamic Capability (Level-II)	Dynamic Capability (Level-III)	DC Code
Seize	Redesign business model	Selecting technology/feature and product/service architecture	Seize 1
		(Re-)Designing revenue structures	Seize 2
		(Re-)Designing cost structures	Seize 3
		Selecting target customers	Seize 4
		Designing mechanisms to capture value	Seize 5
		Designing partnerships	Seize 6
		Having deep market and customer understanding	Seize 7
	Select decision-making protocols	Recognizing inflexion points	Seize 8
		Avoiding and mitigating decision errors	Seize 9
		Avoiding anticannibalization tendencies	Seize 10
		Encouraging creative thinking and action	Seize 11
		Encouraging removal of no value-adding assets and activities	Seize 12
		Learning from mistakes	Seize 13
	Build loyalty and commitment	Demonstrating leadership	Seize 14
		Communicating effectively	Seize 15
		Recognizing non-economic factors, value and culture	Seize 16
	Select enterprise boundaries to manage complements and "control" platforms	Calibrating asset specificity	Seize 17
		Arranging alliances to learn and upgrade	Seize 18
		Deciding and managing integration, outsourcing and insourcing	Seize 19
		Controlling bottleneck assets	Seize 20
		Assessing legal and natural protection through an appropriability regime	Seize 21
		Recognizing and managing complementarities	Seize 22
		Recognizing, managing and capturing co-specialization	Seize 23

and explicit knowledge. Whereas architectural capabilities include those that change modularity, architectures and interoperability. Strategic capabilities concern the innovation and business model- related dynamics (Salazar (2012)).

In an in-depth case study Tsai investigated how focal firms in platform ecosystems respond to environmental changes. Strategic responses can be divided into realignments, updates, exploitations and extensions. Realignments occur when CPPs approach new markets, whether through acquisitions, partnering, service launch or platform opening. Updates are characterized by functional service improvements and complementor encouragement. Extensions can be categorized when CPPs launch existing services in new markets. By this they usually adapt their service portfolio to some extent in order to fit regional service preferences. Further they attract complementors to serve new markets. Exploitations happen when a CPP optimizes the performance/cost relationship for existing services. They add up an additional possible outcome (events) of dynamic capabilities (Tsai, 2013).

Thomas et al. also investigated some dynamic capabilities of platform ecosystems conceptualizing architectural, platform creational and control capabilities (Thomas et al. (2014)). Thus, we have to adapt the dynamic capabilities typology overview (value chain) with these additional findings. Figure 8 illustrates the resulting overview.

Innovation Platform Properties

A further concept that emerges when we analyze dynamic capabilities of platforms is the concept of innovation platform properties. Venkatraman et al. analyzed how a platform's attributes that ground its success can be conceptualized. Innovation platform properties describe the innovation scope, scale and speed (Table 6). They can be seen as dynamic attributes and are of high interest for our investigation. Explicitly, innovation capabilities cover the innovation extent and dimension (scale), the innovation area (scope) and the innovation speed (rate of customer and complementor attraction, adoption and adaption). We include the explications into our code book (Appendix A3), because they include further dimensions into our model. Additionally, we thus have a few measures explicating dynamic capabilities that could

Table 4: Dynamic capability explications - ”Transform” (following Teece (2007))

Dynamic Capability (Level-I)	Dynamic Capability (Level-II)	Dynamic Capability (Level-III)	DC Code
Transform	Manage knowledge	Learning	Transform 1
		Transferring knowledge	Transform 2
		Integrating know-how	Transform 3
		Achieving know-how	Transform 4
		Protecting intellectual property	Transform 5
	Cospecialize	Managing strategic fit so that asset combinations are value-enhancing	Transform 6
	Support open innovation and modularity	Developing integration, coordination and reconfiguration skills	Transform 7
		Adopting loosely coupled structures	Transform 8
		Embracing open innovation	Transform 9
	Strengthen governance	Achieving incentive alignment	Transform 10
		Minimizing agency issues	Transform 11
		Checking strategic malfeasance	Transform 12
		Blocking rent dissipation	Transform 13

Table 5: Dynamic capabilities typology comparison

DC typology		Teece, 2007 Sense	Seize	Transform
Wang and Ahmed, 2007	Adaptive Capability	X		
	Absorptive Capability			X
	Innovative Capability		(x)	

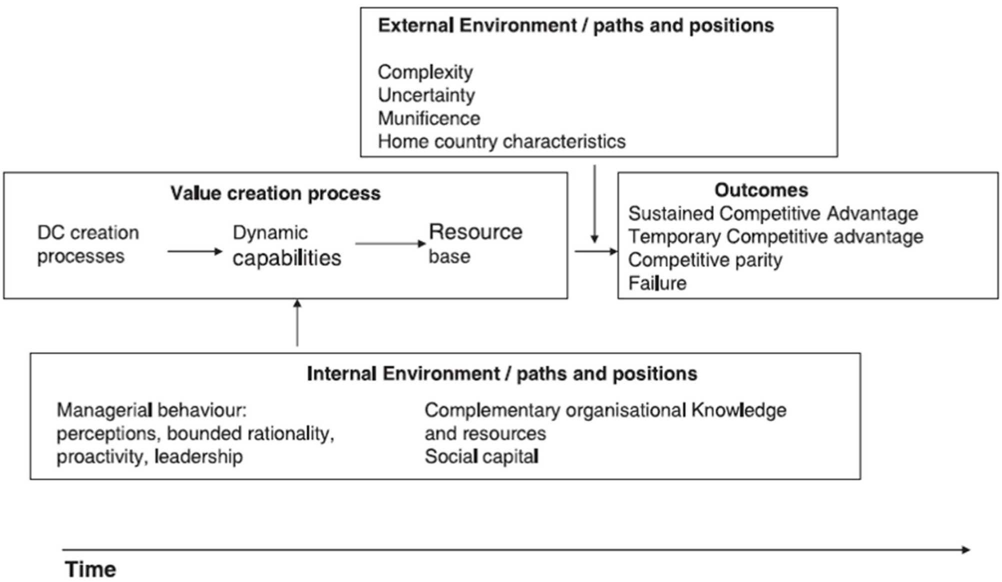

Figure 6: External and internal view of dynamic capabilities (Ambrosini and Bowman (2009))

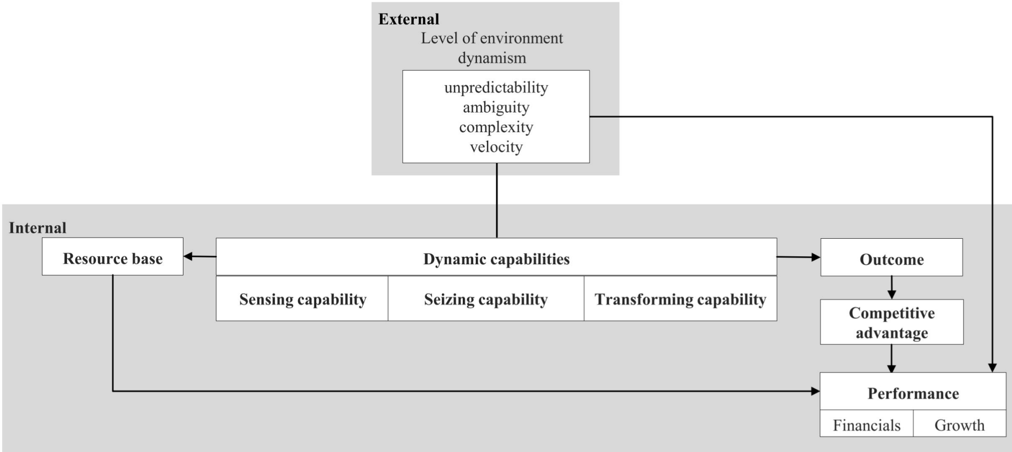

Figure 7: Framework 2 - Dynamic capabilities

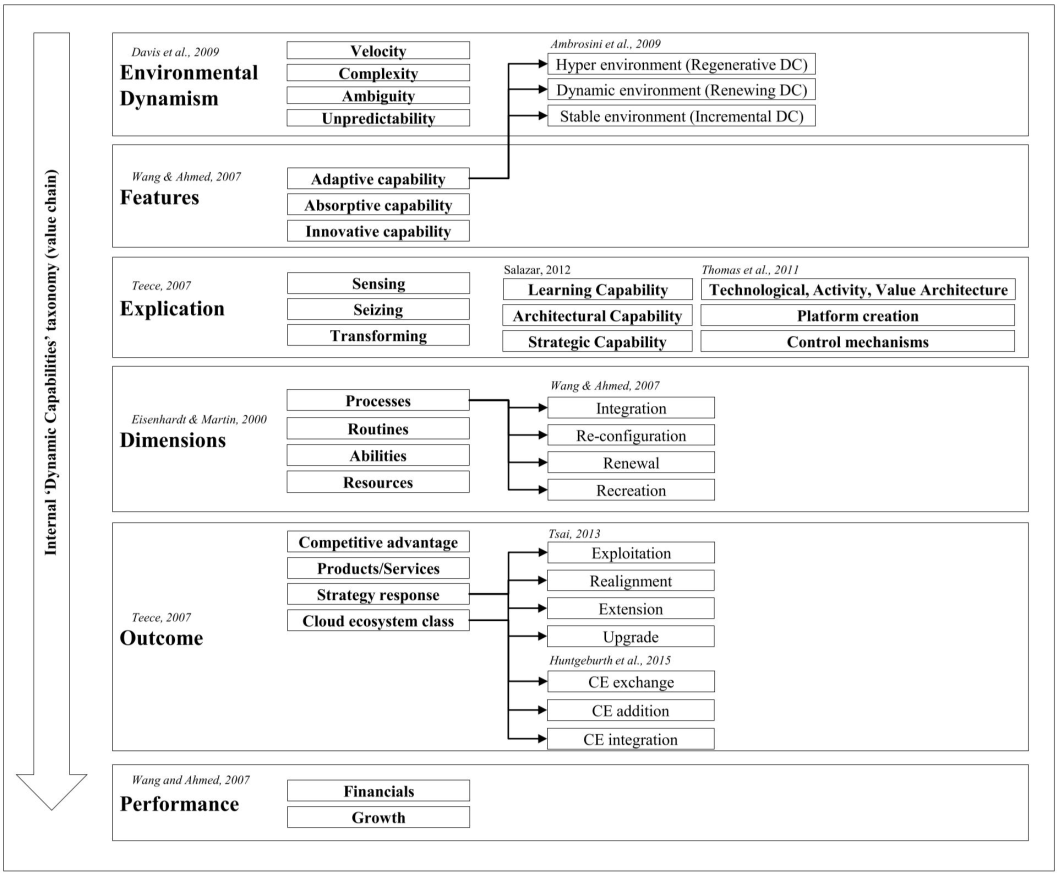

Figure 8: 'Dynamic capabilities in the context of platforms'-typology

help us to operationalize some dynamic capabilities, such as customer attraction rate, complementor adoption speed and platform adaption speed (Venkatraman et al. (2014)).

Contentual comparison

Nonetheless, we check whether Salazar's and Thomas et al.'s dynamic capability explications overlap with Teece's and Venkatraman et al.'s dynamic capability typologies. Table 7 shows that there is a huge overlap. Thus we can neglect Salazar's and Thomas et al.'s typologies at this point. We add Venkatraman et al.'s typology. In order to make the review evidence even stronger we also compare Teece's dynamic capability typology with two further typologies. Hagiu analyzed multi-sided platforms and comes to the conclusion that they accommodate dynamic capabilities in the sense of opportunity identification, risk analysis, business model realignment and cost structure adaption. Also, here we cannot

Table 6: Innovation platform properties (following Venkatraman et al. (2014))

Dynamic Capability (Level-I)	Dynamic Capability (Level-II) (Innovation focus)	Dynamic Capability (Level-III) (Innovation dynamics)	DC Code
Innovate	Innovation scale	Customer network effects	InnoScale 1
		Complementor network effects	InnoScale 2
		Information-based decision making and applied analytics	InnoScale 3
		Modular product and service architecture	InnoScale 4
		Information and technology functionality and exchange	InnoScale 5
	Innovation scope	Customer scope	InnoScope 1
		Complementor scope	InnoScope 2
		Information and technology appliance to multi-industry ecosystems	InnoScope 3
	Innovation speed	Customer attraction rate	InnoSpeed 1
		Complementor attraction rate	InnoSpeed 2
		Customer adoption speed	InnoSpeed 3
		Complementor adoption speed	InnoSpeed 4
		Platform adaption speed	InnoSpeed 5
		Information and technology for open innovation and community	InnoSpeed 6

find new dynamic capabilities that are not already present in our concept (Hagiu (2009a)). Tan et al. showed that also high agreement with parts of Teece's dynamic capability typology. In this sense platform initiation, platform strategy enablement and platform leadership are crucial processes for successful development of multi-sided platforms (Tan et al. (2015)).

2.4.2. Framework 3: Dynamic capabilities in the context of platforms

Finally, we can add all conceptual frameworks and typologies about dynamic capabilities and dynamic capabilities in platform ecosystems into one framework that helps us to define the research questions. Figure 9 shows that the understanding is further advanced by strategy responses as possible outcomes. Furthermore, we have an additional layer of dynamic capabilities that we call "Platform Innovating Capabilities".

2.5. Specification of research questions

From the former created frameworks we can derive the potential and specific lacks in the literature. The open questions appear in the explicit dynamic capabilities (explications), in between the paths of dynamic capabilities and in the relations to actors of the cloud platform ecosystems (Figure 10).

Furthermore, this can lead us to the following research questions.

- RQ1: What specific dynamic capabilities do CPPs use within their ecosystem?
  - RQ1.1: What specific DC explications do CPPs use within their ecosystem?
  - RQ1.2: What paths of DC explications do CPPs use within their ecosystem?
  - RQ1.3: What trends are followed? Can we deduce and reconstruct roadmaps?
  - RQ1.4: What intensity distribution among different DCs can we detect?
  - RQ1.5: To what extent can we verify former research?
- RQ2: Why do CPPs use dynamic capabilities?
  - RQ2.1: Why do CPPs use specific DC explications?
  - RQ2.2: To what extent can we verify former research?
- RQ3: How do CPPs use dynamic capabilities?
  - RQ3.1: How do CPPs use specific DC explications?
  - RQ3.2: To what extent can we verify former research?
- RQ4: With whom do CPPs use dynamic capabilities?
  - RQ4.1: What interrelations occur between CPPs and other actors within its ecosystem?

Table 7: Synthesis of 'Dynamic capability in platforms'-typologies; typology from left rowis covered by top column typology... X:=fully, ...(x):=partly

Target DC taxonomy		Teece, 2007			Venkatraman et al., 2014
		Sense	Seize	Transform	Innovate
Salazar, 2012	Strategic DC	(x)	(x)		(x)
	Architectural DC	(x)	(x)		X
	Learning DC	(x)	(x)	X	X
Thomas et al., 2011	Technological, Activity, Value Architecture	(x)			(x)
	Platform creation		(x)		
	Control mechanisms		(x)		
Hagiu, 2006	Identify opportunities	X			
	Analyze risks				
	Realign business model		X		
	Adapt cost structure		X		
Tan et al., 2015	Platform initiation	X			
	Platform strategy enablement		X		
	Platform leadership		X		

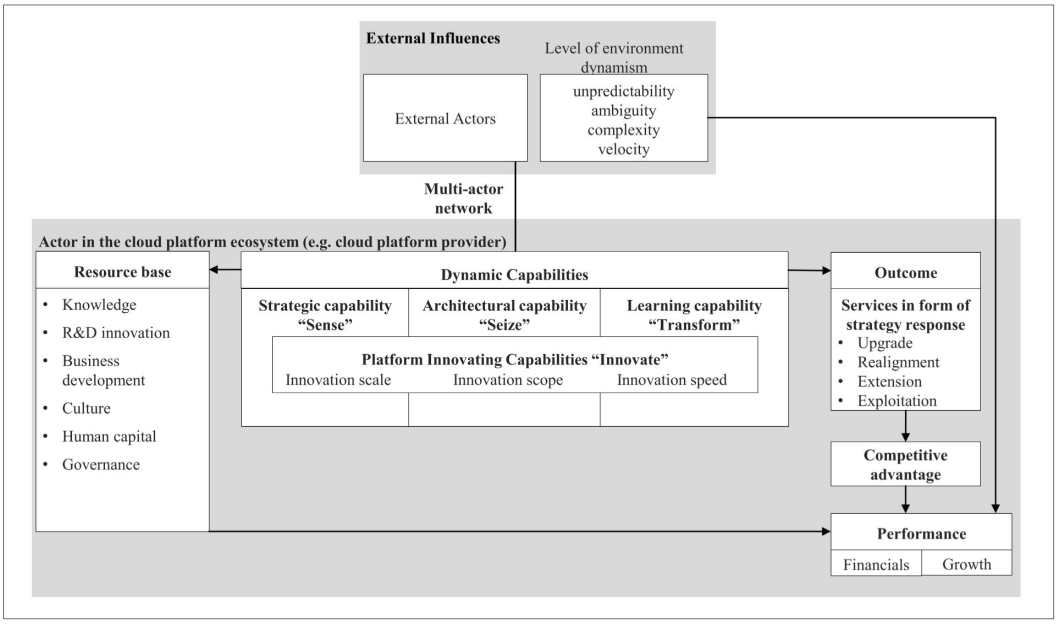

Figure 9: Framework 3 - Dynamic capabilities in the context of platforms

- RQ4.2: What intensity distributions among different ecosystem actors can we detect?
- RQ4.3: To what extent can we verify former research?

- RQ5: What outcomes caused by strategic responses of CPPs that are based on dynamic capabilities can be identified?
  - RQ5.1: To what extent can we verify former research?

2.6. Expectations

Strategic responses

In this sense we have a few expectations regarding the strategic responses of cloud platform ecosystems, in particular cloud platform providers. We expect them to have a vast set of strategic responses that they make available to the public in order to transform them into competitive advantages. Specifically, in the fast changing cloud platform industry it is highly likely that realignments and upgrades occur very often. Furthermore, the speed of strategic responses could

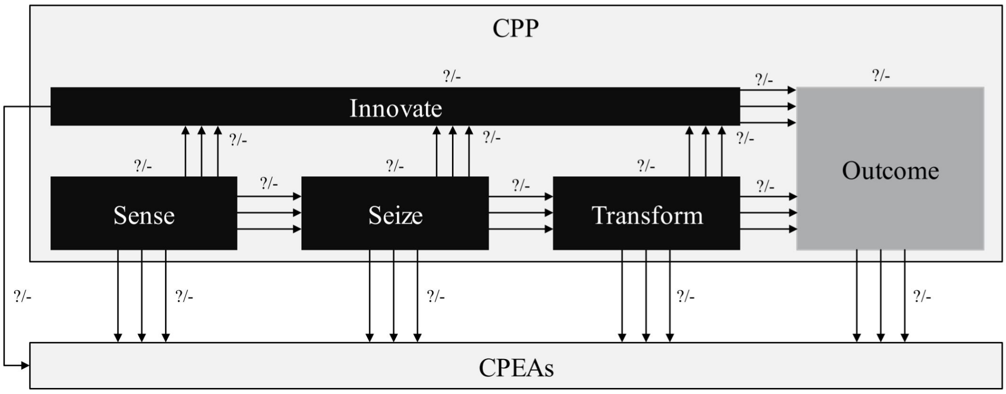

Figure 10: Refined research questions in context

be in line with the general company growth (Tsai, 2013).

Teece's dynamic capabilities in cloud platform ecosystems

We expect cloud platform providers to have a vast set of dynamic capabilities that they develop and apply in their corresponding platform ecosystems. Probably, AWS fulfills capabilities that define their cloud platform business with high intensity, such as "support open innovation and modularity". Furthermore, we should find the general paths in AWS's dynamic capabilities ("sense – seize – transform" and "sense – transform") (Teece (2007)). We further expect them to have intense relationships with the CPE actors, especially cloud recipients. As competition is very intense in the cloud platform industry we further expect AWS to have implemented strong competitor- sensing capabilities. In forms of platform innovating capabilities we expect CPPs to have strong notions of network effects both towards customers and towards partners. Their probably have high innovation speed, scope and scale and aim to increase each (Venkatraman et al. (2014)). Additionally, we expect to find a lot of DC explications and reasons for developing dynamic capabilities.

3. Part II: Methodology

In this chapter we outline our methodological approach to answer the research questions. First of all we give a short introduction into case study and mixed-methods research design. Secondly, we give an overview about the methodology we composed and verify the most important research design decisions based on a review of methodological flaws initiated by former research.

3.1. Case study research

3.1.1. Case study characteristics

A case study is a research method that allows to view, investigate and evaluate specific records in history and drawing conclusions from them. The subject unit can range from a single person to large systems and organizations. One of the biggest advantage of a case study compared to other methods is its suitability for in-depth explorations and explanations of research domains. This method is most appropriate when dealing with behavioral or social problems with large amounts of qualitative data. We choose the case study method because we want to answer the "what"-, "how"- and "why"-related research questions stated earlier. Furthermore, we want to understand the real-life context of the procedural and network-related phenomena of the platform ecosystem domain. Last, the case study method can include a variety of sources for higher construct validity (Yin (2009)).

3.1.2. Case study design

Design components

Starting points of a case study design are predominantly fundamental aspects that are linked between research questions and possible outcomes. In chapter 4.5 we already have stated our research questions and in chapter 4.6 our propositions. Once again, we want to make clear that the units of our analysis is 1) the individual company unit (subsidiary) of Amazon.com called Amazon Web Services, 2) broader groups of CPE actors that consist of individual companies and private entities, 3) certain enterprising events, 4) enterprising decisions, 5) enterprising structures as well as 6) enterprising processes. We link the previously stated qualitative expectations to qualitative data that needs to be interpreted before conclusions can be made. Furthermore, quantifications of the qualitative data and further application of analytic techniques help for the interpretation. In the end a proper quality assessment is needed to judge the generalizability and validity (Yin (2009)).

Assuring high quality of research design

The quality of good case study design is measured on the basis of four categories that we fulfill in good extent in this study (see chapter 7.4). The categories are construct validity, external validity, internal validity and reliability (see Table 8). Construct validity refers to the concept itself. With that the accuracy of the procedure leading from observed facts to real mechanisms should be as high as possible. Moreover, external validity shows the generalizability, thus the feature to abstract from case-specific results to other setups and finding the same results. Internal validity refers to the correctness of logical reasoning. Last, reliability points out the traceability and reproducibility of the entire method application (Yin (2009); Miles et al. (2013); Gibbert et al. (2008)).

3.1.3. Case study methods

Mixed-methods research
Mixed-methods research refers to the combined use of mutually exclusive research methods, e.g. quantitative together with qualitative data and analyses. We use a mixed- method research design in order to get a much more comprehensive view of our units of analysis, both in depth and width. Furthermore, an optimized research strategy with proper quantitative and qualitative elements can lead us to answers in a much more pragmatic way. Another valuable property of this type of research design is that we are able to quantify qualitative data and qualify quantitative data respectively (data integration and transformation) (Creswell (2013); Creswell and Clark (2007)).

Supportive software
Mixed-methods research designs often go hand in hand with the use of supportive software applications that we use for our purposes, too. Usually, those purposes are data combination, integration or conversion either sequentially or concurrently. For this special-purpose Computer Assisted Qualitative Data AnalysiS (CAQDAS) software, spreadsheet software and search engines among others can be used (Bazeley (2006)).

We make use of a CAQDAS software named ATLAS.ti. (Friese (2014)), Microsoft Office Excel and Google's search engine. ATLAS.ti is best-fitted for qualitative research purposes and enhanced by valuable mixed-methods research functions. Furthermore, ATLAS.ti is widespread and very commonly used among researchers (Fielding and Cisneros-Puebla (2009)). In comparison to the also very famous tool MAXQDA its trial version is not time-restricted what favors you as the reader (Kuckartz (2014)). In particular, we use ATLAS.ti in order to assign conceptual codes to raw case material and to analyze quantified associations out of qualitative data. Furthermore, it serves as a part of our case study database. Additionally, we make use of Microsoft Office Excel to statistically analyze quantified data that was qualitative data before. It also supports us in the creation of matrices and the storage of case material (Meyer and Avery (2009)). Google's search engine helps us to find valuable case material on web sites. Self-build web crawlers on the basis of Microsoft Office Excel VBA supports our web crawling processes (i.e. routines that download the data and transform the data format) (Brophy and Bawden (2005); Smyth et al. (2009)).

Case study data analysis
One of the most important stages in case study research is the data analysis. In an abstract way this includes ways of data reduction, data display and conclusion drawing/verification. With the help of coding processing (codebook needed) the data gets reduced. After this, data can be displayed in data matrices. Specific analytic techniques like pattern matching and time series analysis can help to draw the right conclusions (Miles et al. (2013); Bazeley (2009)). When dealing with qualitative and quantitative data, the right analytic technique needs to be assessed including process and event data (Langley (1999)).

3.2. Method overview

Link between research questions and research design
At this point we want to make sure that the reader understands the close link between the research questions (chapter 4.5) and the previously stated research design. As one can see in Figure 11, we start our investigation by analyzing AWS events (announcements) about strategic responses (Tsai, 2013) to environmental changes in order to gain a pragmatic overview about the DC outcomes. This part is closely related to AWS's change in time, its trend-enthusiasm, ecosystem actor reference and geographic span. The analytical method time-series analysis helps us to create a chronology of AWS's market dynamics and sense the focus of the study for the later explication.

Later, we investigate the explicit DCs (Teece (2007); Venkatraman et al. (2014)) in very detail led by the focus of AWS's market dynamics.

Research design overview
Our research design (Figure 12) basically follows a concurrent transformative design. This means that for all types of data, either qualitative or quantitative, we concurrently process the data at each research stage. Furthermore, in between we have a transformation-stage ("Data conversion") that we use to translate data types. This process was chosen in favor of others, because it perfectly fits our exploratory but also explanatory research questions. Furthermore, it is optimized to originate from conceptual frameworks and offers highest flexibility in data analysis (Creswell (2013)).

Additionally, we follow an embedded, single-case design. Different units of analysis are incorporated into a single case design. This facilitates an in-depth case study without much complexity (Yin (2009)).

4. Part III: Case Study - Dynamic capabilities within the Amazon Web Services ecosystem

In this chapter we apply our methodological approach to answer the research questions. First of all we give a short introduction to Amazon Web Services (AWS). Secondly, we prepare the case and select the case data. After the data collection we convert it through coding. Focus point of this section will be the case study analysis where we gather the insights that will finally end up in results.

4.1. Introduction

4.1.1. Company overview

Amazon Web Service (AWS) is a company that offers cloud computing services and is in ownership of the world's

Table 8: Criteria for judging case study research designs (following Yin (2009))

Criteria	Description	Tactics
Construct validity	Identifying correct operational measures for the concepts being studied	Use multiple sources of evidence, establish chain of evidence, have key informants review draft case study report
Internal validity	(for explanatory or causal studies only) seeking to establish a causal relationship, as distinguished from spurious relationships	Do pattern matching, do explanation building, address rival explanations, use logic models
External validity	Defining the domain to which a study's findings can be generalized	Use theory in single-case studies, use replication logic in multiple-case studies
Reliability	Demonstrating that the operations of a study – suchas the data collection procedures – can be repeated, with the same results	Use case study protocol, develop case study database

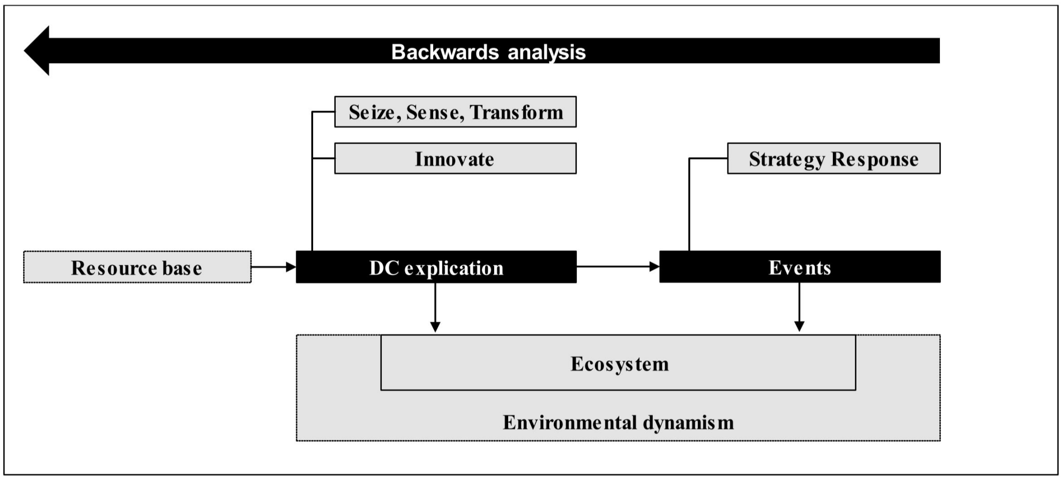

Figure 11: Link between DC-CPE-specific research questions and research agenda

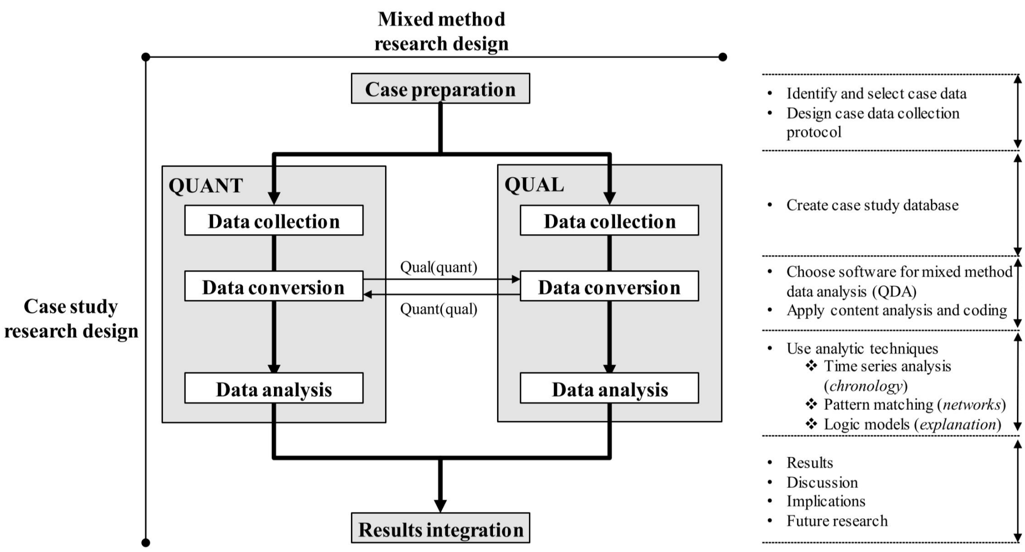

Figure 12: Research design overview

largest retailer Amazon.com. During its ten years of history it developed a vast set of services available on-demand for customers worldwide. A huge ecosystem has been built around AWS.

History

At the beginning of the 21th century Amazon.com began to realize that excess resources of its largescale IT infrastructure are probably interesting for use by other companies. Thus, they created a few basic services available via web-based front-end applications. The first time they offered a model for highly scalable, secure, virtual and low cost computing services that are easily accessible over the internet. It helps companies to turn fixed costs for infrastructure into much more operational costs. Thus companies are supported in saving money and enabling innovation. AWS can be seen as Infrastructure- as-a-Service (SaaS) with a lot of Platform-as-a-Service elements (Varia & Mathew, 2013). Its business value creation for customers increased more and more over time (Perry and Hendrick (2012)).

Services

AWS offers a variety of services that enable companies to store, process and share data. They began with their offering of Amazon Elastic Compute Cloud (EC2) and Amazon Simple Storage Service (S3). Today they offer more than 70 services in over 13 regions worldwide. Moreover, the service span has increased from basic services to specialized (industry-specific, task-specific, vendor-specific) services. For example, today AWS also offers services in the field of mobile computing, internet of things, analytics, corporate services, development, security and networking.

For a more comprehensive view on the various services provided by AWS see Appendix B2 (Qian et al. (2009)).

Business Model

AWS's business model is strongly oriented towards very variable revenue streams besides having a generally fixed cost structure. The large spread of customer segments is leveraged by strong customer relationships and very technical channels. Its value proposition is focused on a "pay-as-you-go"-model. While having various technical activities and resources, AWS also holds strong relationships with technical partners. For a detailed view of AWS's business model see Appendix B3 (van Eijk (2014)).

Ecosystem

AWS's success is truly based on its huge ecosystem that is managed profoundly. They manage a so called AWS Partner Network (APN) where consulting and technology partners are hold tight in order to deliver maximum value to its customers (Isckia et al. (2009)).

4.1.2. Rationale for AWS

We choose AWS for this case study because it represents the strongest indicators for possessing DCs. Competitive advantage, financial performance, growth are perfect indicators to spot strong capability to respond to dynamic changes of the environment. AWS shows partial superiority in comparison to other market participants in these three categories and clearly stands out as the market leader (Wang and Ahmed (2007)).

The market share provides information about the competitive advantage. AWS has by far the highest market share in the IaaS market segment (32% compared to the next follower Microsoft, with 12%) (see Appendix B4) (Synergy Research Group (2016)). This compares to AWS's cloud platform revenues of 6,000 million US$ in 2015 and Microsoft's revenues in this sector of 1,577 million US$ (see Appendix B5) (John R. Rymer, 2015). For growth we set the revenue CAGR (continual annual growth rate). Despite AWS's large size they had a revenue CAGR of 53%, Microsoft 100%, respectively (see Appendix B4) (Synergy Research Group, 2016). Financial performance can be measured based on its total profitability. AWS had a profitability of 24% (0,604 bn$ operating income / 2.57 bn$ revenue) in 2015 which is very high and serves as a good proxy for the execution of dynamic capabilities (Wingfield (2016)). For the competitors no data is available. Furthermore, in pre-study tests we investigated that there is much more secondary data available for AWS-related content.

4.2. Case preparation

First, we prepare the case study by identifying and selecting the case data as well as by designing a case data collection protocol. Secondly, we collect all quantitative and qualitative data that was identified earlier and store it in a case study database. In a next step we prepare our research setting in ATLAS.ti and Excel. We develop a code book and convey it into ATLAS.ti. If reasonable we convert data types for more meaningful insights. Last but one we analyze the data through time series analysis, pattern matching and logic models. We explain the reasoning for this later in this paragraph. In the final step we synthesize and discuss the findings a well as draw implications for theory, practice and future research.

Case data identification and selection

The case data for this study is well-considered and based on common standards in the research field. We prefer secondary over primary data as this allows a much better reproducibility and leads to much more explorative study (Hox and Boeije (2005)).

A vast amount of data about AWS is available online that requires thorough quality assessment. We are interested in high quality and completeness of the secondary external data for this study. A search of "Amazon Web Services" via Google's search engine delivers roughly 4 million results. We categorize the available data into the following: announcements (A), customer/partner case studies (B), news pages (C), whitepapers (D), investor information reports (E), articles (F), industry reports (G), interviews (H), books (I), job vacancies (J), social media posts (K), other website information (L) and forum posts (M).

In order to improve the quality we exclude the information of (K)-(M) and include only (A)-(J). While the data categories (A) till (I) are standard sources for providing evidence in case studies research (Yin (2009)). We make use of job vacancies (J), too. The incorporation of those into research has been weighed positively by (Kureková et al. (2013)). We neglect the rest of the source categories (K-M) because of simplicity reasons. This leads us to a coverage rate of 63%[2]. That means, we include 63% of the available external secondary information about AWS. We miss 22% of the information because of categorization flaws.

4.3. Data collection

Data collection protocol

The design of a data collection protocol helps us to systematically gather the previously identified data. This forms the case study database with that the reader is able to reproduce the data setting. The data collection protocol holds the URL source address under which the source is available to the public, the retrieval date, a unique identification number and the file name (Brereton et al. (2008)).

Case data collection

We describe the data collection plan. First, we take a category and search for information that preferably is provided by AWS, then by a third party. Then we store the data. If needed we build a web crawler on the basis of Excel VBA that automatically downloads sites into Excel format and transforms into a standardized format (e.g. for case studies, announcements, etc.). In later stages we add data if necessary based on more specific search terms (e.g. DC explications/microfoundations or CPE actors). After the extraction all documents are saved as pdf formats to be executed further in CAQDAS software.

Case database generation

After some revisions the pdf-based case database is generated and is completed with the coded .hpr7 protocol files (ATLAS.ti) and Excel-based analyses. Additionally, an overview (see Appendix A1) summarizes all content of the case study database based on the following structure: source category, explanation, filename, URL(s) and retrieval date.

Case database

A table of all secondary data source types, the corresponding frequencies and the year span are displayed in Table 10. All in all we accumulate 16,675 data pages within this case study. By far job vacancies, blog pages and whitepapers make up most of the data (74%). This is because they have a huge volume and we want to incorporate a complete picture of the study. But we value the content from articles, news pages and interviews (3%) as important as the others if not even more important.

All documents get imported into ATLAS.ti in order to initialize the .hpr7 file. For simplicity we merged many categorically consistent pdf files to result into 90 primary documents.

4.4. Data conversion

The data conversion consists of a two-step approach that characterizes the link between the DC-CPE-specific research questions and the research agenda (Figure 11) as well as the multi-method approach we use and described in chapter 5.2. Figure 13 shows the general overview of the conversion in combination with the applied supportive software tools. For both conversion steps we apply qual-to-quan-to-qual conversions.

Conversion 1 for quantified DC outcomes

The first conversion batch aims to transform the announcement data into interpretable time series data. The announcement data is described as date data (quant) and text data (qual). For each of the 1,570 announcements AWS made in the last 11 years we assign binary codings (1=yes, 0=no) for a set of categories that are linked to its dynamic capability outcomes. We use four categories and overall 47 segments and sub-segments in order to set the connections. For a full view on all categories, segments and sub- segments see Table 9. The most important category of all is the strategy response (Tsai, 2013). After coding we count the corresponding codings in Excel pivot tables based on different time intervals and different segment levels (Castro et al. (2010)).

Conversion 2 for DC codings

The conversion of all qualitative data is applied in ATLAS.ti to create codings, thus assignments of quotations to code phrases. The code phrases are based on the prior conceived frameworks and are stored in a codebook (Appendix A2). The codes are extracted from the Tables 2, 3, 4 and 6 (conceptual frameworks).

We apply a standard 2-round coding for all documents in this study (see Figure 14). After the code book definition we search via ATLAS.ti's "Auto Coding"-function after each code. For the required search expressions we use a variety of synonyms that are stored in the codebook as well. Each promising coding is checked manually before coding (check "Confirm always"). After a refinement of the codebook (usually more expressive synonyms) we do a second round coding that delivers additional refinement. We search explicitly for co-occurring, refined and unique DC explications. Please visit the appendix A3 for an ATLAS.ti-based visualization of the code network view. The coding results in 615 quotations (Kohlbacher (2006); Saldaña (2015)).

4.5. Case study analysis and results

4.5.1. Analytics overview

The case study analysis is crucial for leading us from raw time series data and codings to valuable insights in order to

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[2] The following query at Google's search engine delivers 4170K answers: "amazon web services"

T he following query at Google's search engine delivers 3410K answers: "amazon web services" -"social media" -"website information" -forum

T he following query at Google's search engine delivers 1550K answers: "amazon web services" -announcements -"customer case study" -"partner case study -"news" -whitepaper -"investor" -article - reports -interviews -books -"job vacancy"

T he following query at Google's search engine delivers 933K answers: "amazon web services" -announcements -"customer case study" -"partner case study -"news" -whitepaper -"investor" -article - reports -interviews -books -"job vacancy" -"social media" -"website information" -forum

Coverage rate = (4170K-1550K)/4170K = 63% Miss rate = 933K/4170K = 22%

Table 9: Data sources overview

Data sources	Pages	Year span
AWS job vacancies	5,728	2011 - 2016
AWS blog pages	3,872	2004 - 2016
AWS whitepapers	2,796	2008 - 2016
AWS investor information reports	1,459	2004 - 2016
AWS customer/partner case studies	1,427/4	? - 2016
AWS books	389	2013
AWS industry reports	369	2011 - 2016
AWS articles	244	2009 - 2016
AWS news pages	186	2006 - 2016
AWS interviews	100	2006 - 2016
AWS announcements	60	2005 - 2016
AWS research papers	47	2009 - 2016
Overall source pages	**16,681 (490 Mbyte)**	**2004 – 2016 (12 Years)**

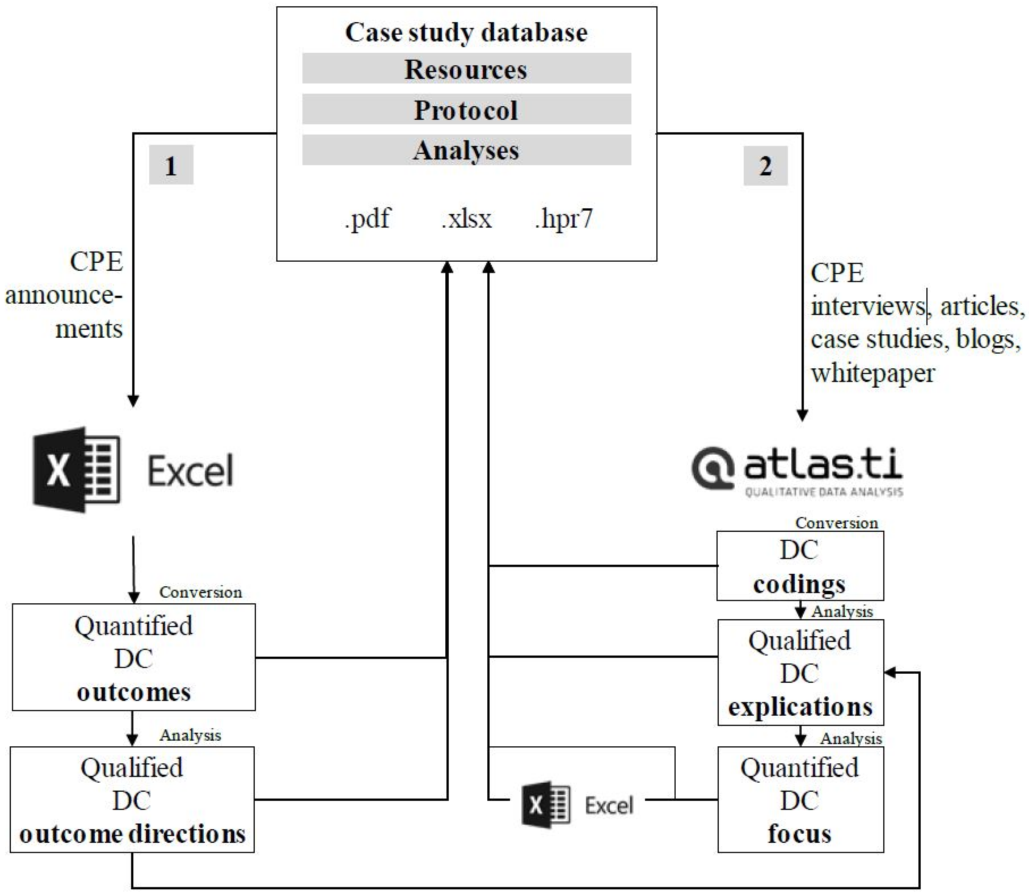

Figure 13: Research design overview - tool view

answer the research questions. We decide to use a set of analytic techniques that are all very diverse leading us partly to very broad and very detailed results. Here, the in-depth character of the study is revealed.

Table 10: Categories and segments for the coding of AWS announcements

Geographic segment	Strategy response	Trend topic	Ecosystem actors
Virginia	Realignment	IoT	customer
Govcloud	New company is acquired in a new market	Automation	partner
Oregon	New partner is acquired in a new market	Optimizing power/cost	auditor
California	New service is launched in a new market	Globalization	regulator
Paulo	New platform opening mechanisms are established	Compliance and security	investor
America etc.	New incentives are implemented to attract new complementors	Green data center	developer
Frankfurt	Upgrade	Community / Event / Marketing	software vendors
Ireland	Existing service is improved by a functionally for a existing market	New service announcement	entrepreneur
Europe etc.	Complementors are encouraged to innovate		
Beijing	Backward compatibility is maintained		
Seoul	Extension		
Tokyo	Existing service is launched in a new market		
Singapore	Existing service is adapted for a new market		
Sydney	Complementors are attracted to serve a new market		
Asia etc.	Exploitation		
	Existing service is improve in performance/cost ratio		

The diverse set of analysis techniques and their corresponding assignment to the research questions is displayed in Figure 24 (Miles et al. (2013)).

We first begin with the analysis of the time series data (Yin (2009)) and roadmapping (Groenveld (2007)). In order to gain first hints where to concentrate our study analysis on. Despite the fact that this helps us just to answer a few research questions, it supports us to analyze the explanation part (Logic models) in a much more pragmatic way. In a second step we analyze patterns of CPE actor intensities and interrelations. We build heatmaps and network views to answer the research questions RQ1.4 and RQ4.1-RQ4.3 (Miles et al. (2013)). In a final step, we analyze the explicit characterizations of AWS's dynamic capabilities. Logic models help us to gather paths and explications in order to answer most of the research questions (Yin (2009); Miles et al. (2013)).

4.5.2. Time series analysis (chronology)

We investigate the announcements of AWS in order to understand its dynamics in strategy responses, thus how it changes service exploitation, realignment, extension and upgrade. Time series analysis delivers the setting to add a dynamic component to thus time-static AWS announcements.

DC chronology

Graph 1 shows a plot of all 1,570 AWS announcements categorized into strategic responses (top-segment) in monthly intervals. It can be seen that the overall number of strategic responses follows approximately an exponential trend. Whereas we cannot see cyclical components (continuously strong dynamic capabilities) we see seasonal patterns that occur in little spikes roughly all three month and some irregularities (Hamilton (1994)). Nonetheless there is a continuous strong notion of strategic responses in general. All kinds of strategic responses are existent (Chart 15).

The Chart 16 (yearly intervals) illustrates that there is a continuous, nearly exponential growth for strategic responses, but interestingly within the years 2014-2015 service realignments have increased extraordinary.

In order to explore the relative composition of strategic responses year-on-year a little bit more we create Chart 17. We see that AWS moved from a strong realignment phase in 2006 to a much more upgrade-oriented strategy for the following years. At this point we have to point out again that we have count metrics and a new service launch (realignment) is linked to much more effort than updates.

Nonetheless, in Chart 18 we see that AWS predominantly focuses on functionality improvements when updating services.

When extending services AWS very often introduces existing services into new markets and attracts new complementors with that (Chart 19).

Realignments are nearly always guided by new service

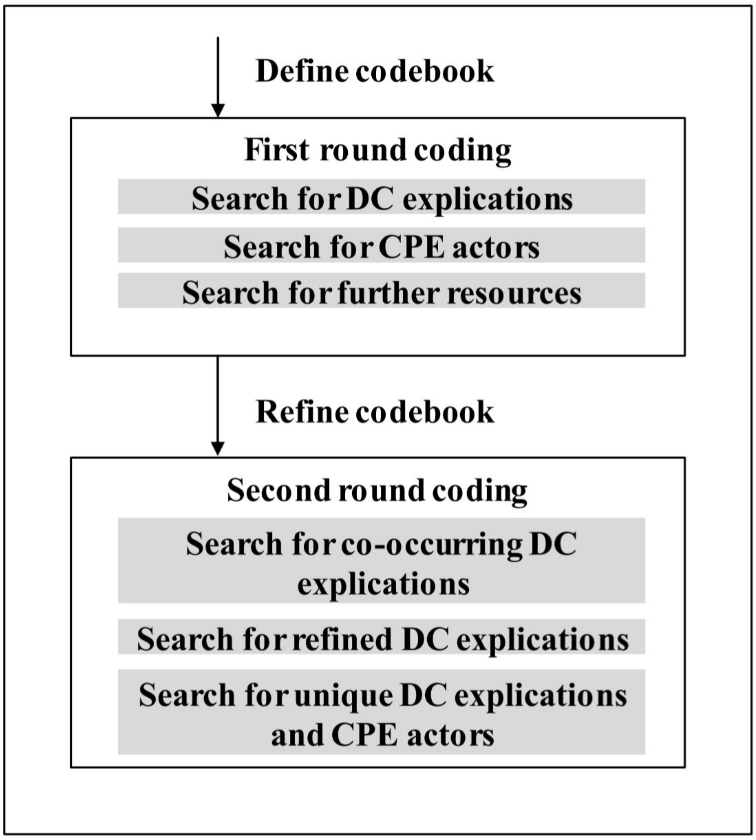

Figure 14: Coding methodology

Table 11: Analytics methods overview

Analysis technique	DC construct	Outcome	Addressed research questions
Time series analysis (chronology)	DC chronology	Statistics	RQ5.1
	DC roadmapping	Trend roadmap	RQ3
Pattern matching (networks)	DC actor intensity	Heat map	RQ1.4 RQ4.2
	DC actor interrelations	Network	RQ4.1 RQ4.3
Logic models (explanation)	DC paths	Paths	RQ2
	DC explications	Explanations	RQ1.1 RQ1.2 RQ1.3 RQ1.5 RQ2.1 RQ2.2 RQ 3.2 RQ3.1

launches to address new markets in general (Chart 20).

AWS addresses a variety of trends (Chart 21) that are also confirmed by Werner Vogels, AWS's CTO (Werner (2015)).

A large proportion of trends AWS responded to are new service announcements, compliance and security and automation. These three trends account for over 3/4 of the trends incorporated in strategic responses. Interestingly, these are very different among themselves, but very characteristic for cloud computing. For example compliance and security is one of the big hurdles nearly every executive names that is associated with cloud computing. Another key characteristic in this industry and especially for AWS is the continuous optimization of power in regard to cost. AWS surely always seeks to diminish prices and to give more computing power to their customers.

When we look at the geographical span of AWS (Chart 22) - so how dynamicly it spread over the world so far - it is obvious that there was a constant spread to the world's largest continents, America, Asia and Europe. But interestingly there are two major spikes that come along in 2012 and in 2015.

Considering the notion of CPE actors in regards to AWS announcements (Chart 23), we see that in more than every second case AWS addresses customers. Once again, here we can see that AWS focuses customers in a very strong notion. Approximately, one third of the announcements are devoted to developers. Thus, in general AWS speaks to its cloud recipients also via announcements.

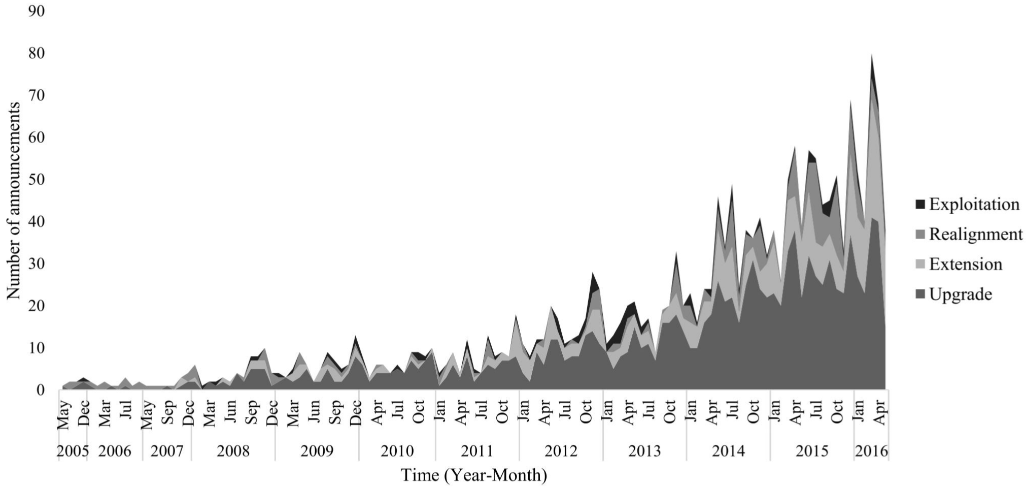

Figure 15: Absolute monthly level-1 strategy responses of AWS from 2005 to 2016 (# AWS announcements)

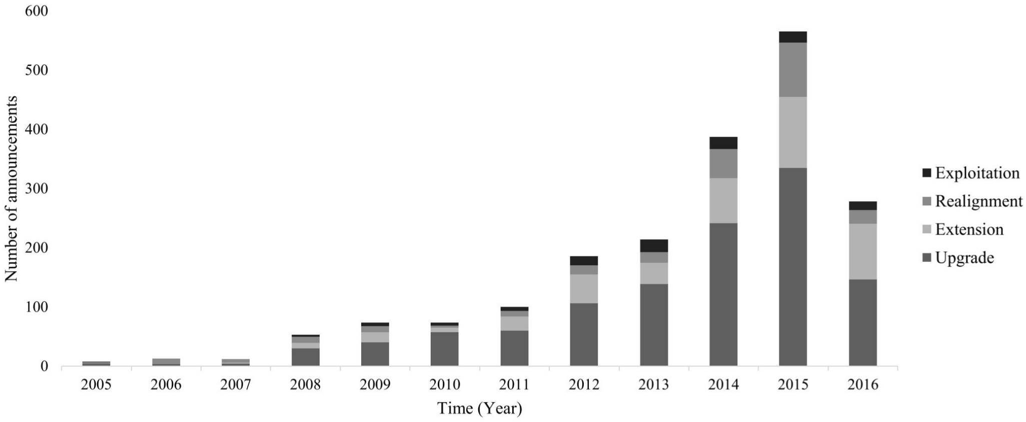

Figure 16: Absolute yearly level-1 strategy responses of AWS from 2005 to 2016 (# AWS announcements)

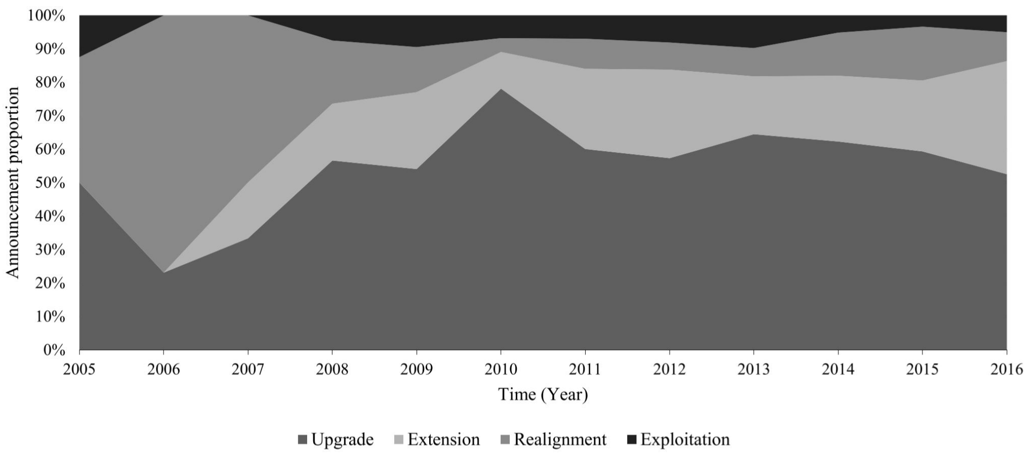

Figure 17: Relative yearly level-1 strategy responses of AWS from 2005 to 2016 (# AWS announcements)

DC roadmapping
The generation of trend roadmaps in regard to dynamic capabilities helps us to understand the integration of DCs in the strategy planning process. We address the major trend segment (IoT = internet of things) out of Chart 21 to outline the roadmaps (Groenveld (2007)). We test the application

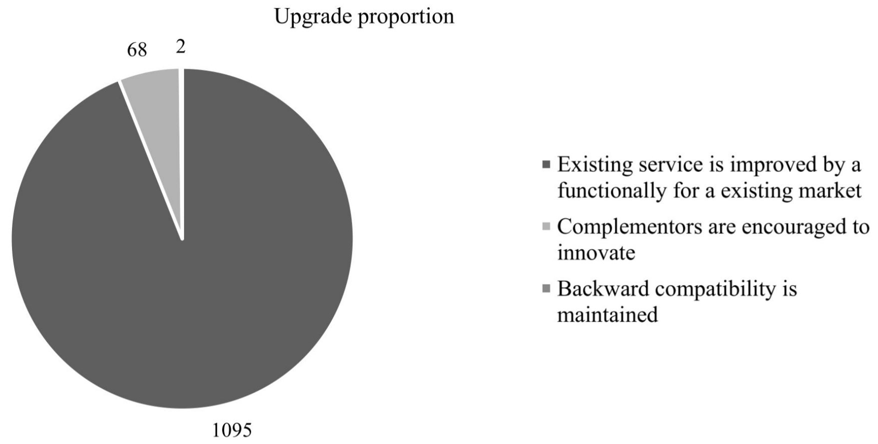

Figure 18: Relative composition of level-2 strategy responses of AWS in 'Upgrade' (# AWS announcements; overall 2005-2016)

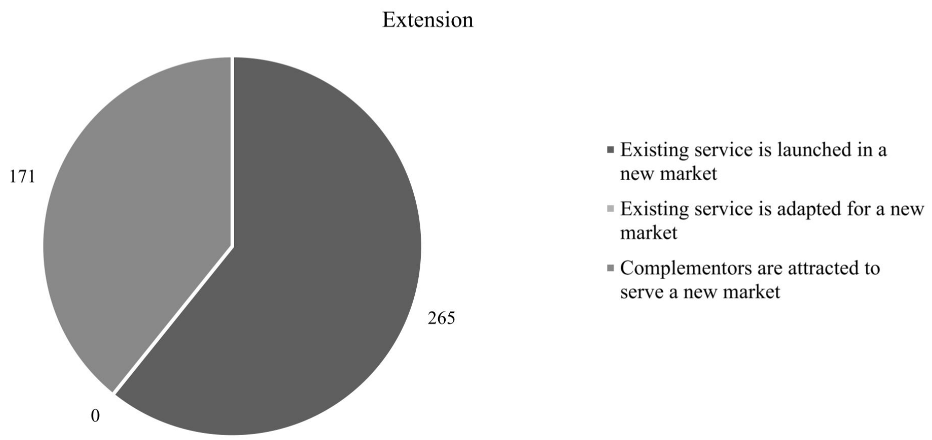

Figure 19: Relative composition of level-2 strategy responses of AWS in 'Extension' (# AWS announcements; overall 2005-2016)

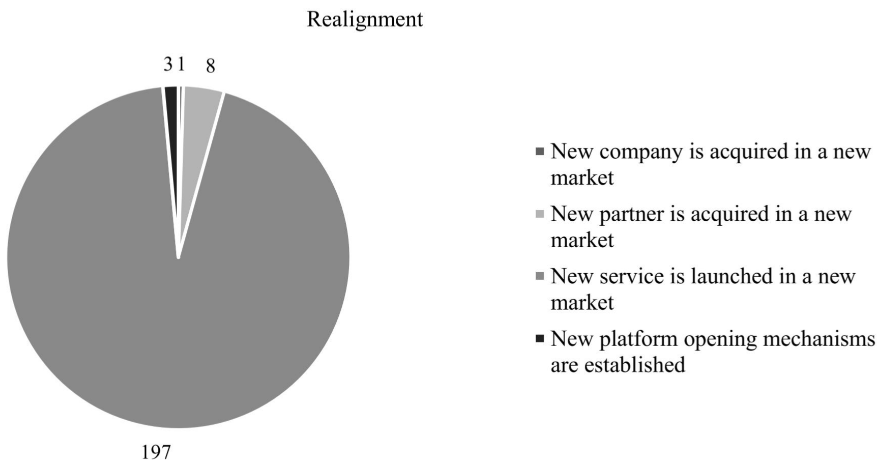

Figure 20: Relative composition of level-2 strategy responses of AWS in 'Realignment' (# AWS announcements; overall 2005-2016)

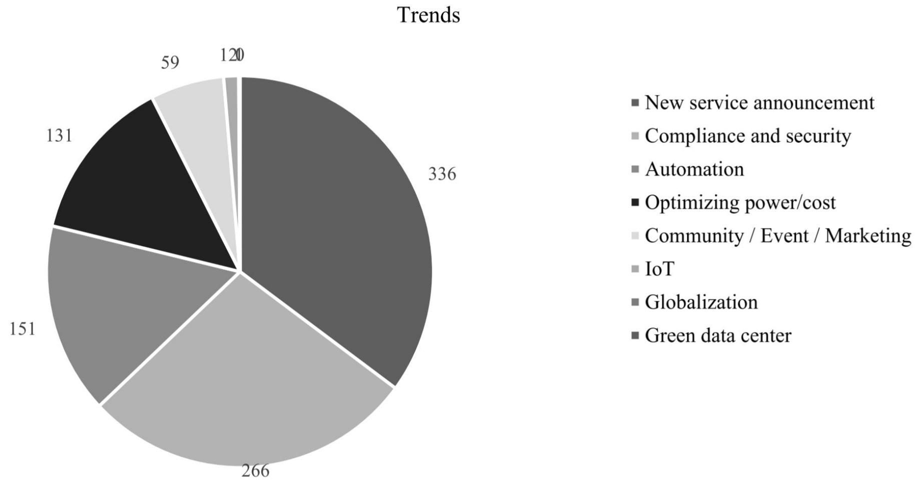

Figure 21: Relative composition of trend directions of AWS (# AWS announcements; overall 2005-2016)

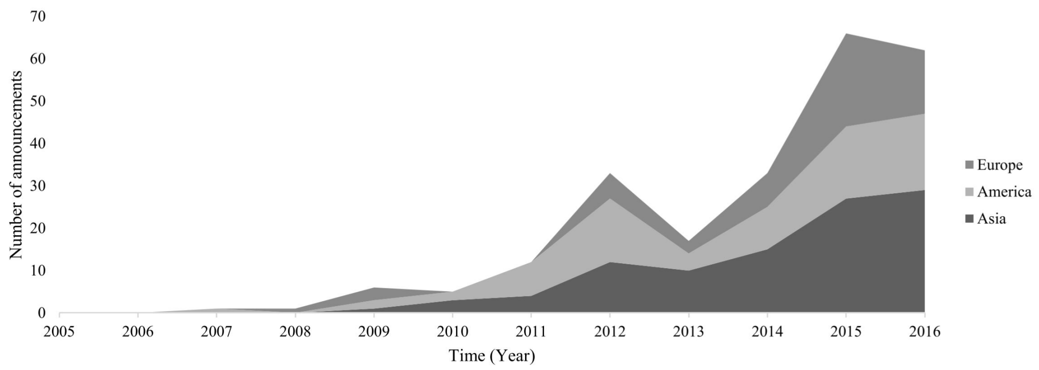

Figure 22: Absolute yearly geographical responses of AWS from 2005 to 2016 (# AWS announcements)

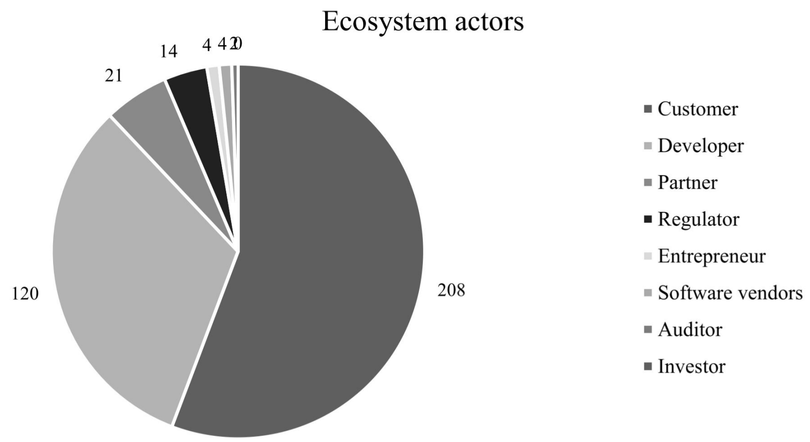

Figure 23: Relative composition of CPE actor directions of AWS (# AWS announcements; overall 2005-2016)

of roadmaps in the context of dynamic capabilities in cloud platform ecosystems. Therefore we only apply a single trend segment. The IoT trend segments seems to be very promising as it also includes the acquisition of external companies in order to gather knowledge. Furthermore, this trend topic is very up-to-date.

The roadmap (Figure 24), refers to the very current topic of IoT (internet of things). We see that the general emergence of the trend topic, in combination with customer needs and developments of outside researchers motivated AWS to build (dynamic) capabilities in this knowledge sector. First, they sensed the market changes and customer needs. Later, they developed an IoT business model and encouraged innovation in this field even further. Lastly, they acquired and integrated an IoT startup (2lemetry), as well as prior knowledge about communication and security. The roadmap results into three major realignment announcements. From this sound time analytical model we can infer that dynamic capabilities are necessarily set between CPE actor's dynamic inputs, e.g. movements, changes, needs, and on the other side DC-oriented strategy responses.

4.5.3. Pattern matching (networks)

Presumably, we investigate the DC-CPE intensities and networks. We thus go one level deeper into the topic before we start to show AWS's explicit DCs.

DC actor intensity

First, we build a matrix assigning each DC code (y-axis) to a CPE actor (x-axis) (Table 10). We code the magnitude of each co-relation by reading and analyzing the corresponding codings (quotations). We subjectively evaluate the intensity of each relation, meaning (3) strong, (2) medium, (1), low and (-) no intensity. The strength of intensity is based on the corresponding orientation of the qualitative statements. We look for frequency, sentence position and emphasis of keywords (Miles et al. (2013)).

We infer that the top 5 DCs in number of intensity counts are (1) Sense 1 (sensing external innovation), (2) Sense 7 (identifying changing customer needs), (3) Seize 3 ((Re-)Designing cost structures), (4) Transform 2-4 (transferring knowledge; integrating know-how; achieving know-how), (5) InnoScale 5 (information and technology functionality and exchange). Nearly all have an average intensity of at least 2.0. Likewise, we find out the top four CPE actors that are in descending order: the CPP, cloud recipients, cloud partner ecosystem and outside innovators/research institutes.

DC actor interrelations

As we just discovered the intensity of DCs and CPEs separately, we now focus on a combined view on the interrelationships. Thus, we create a network (Figure 28) that describes the focus DCs of CPPs and focus CPE actors accordingly (Miles et al. (2013)).

As illustrated in Table 10 the distribution of CPP DCs to CPE actors is very heterogeneous and manifold. For simplicity reasons we cluster some DCs into groups. Some DC groups are much more intense connected and oriented to CPE actors. A general rule we infer is that in each DC stage (sense, seize, transform) AWS is oriented towards all CPE actors at least once, except for competitors. AWS only interferes with competitors within the seizing process. Furthermore, all clustered DCs have connections to CPE actors except the DC "Align reward system".

DCs with high connectivity towards CPE actors (at least 4 connections to CPE actors) are "Sense RDI", "Identify customer and market characteristics", "Profit maximization mechanisms" and "Manage knowledge".

DCs with low connectivity towards CPE actors (less than 4 but more than 0 connections to CPE actors) are "Encourage open innovation", "Turn customer understanding into service architecture", "Create partnerships", "Select process making mechanisms", "Encourage creativity", "Create business-enhancing culture", "Specialize strategic orientation" and "Specialize service architecture with externalities".

4.5.4. Logic models (explanation)

A logical chain of evidence on DC explications is gathered through explanation building. This helps us to gather answers for the remaining research questions. First, we identify the overall connectivity of DCs. For each DC on level-III we calculate the number of co-occurrences with other DCs on the same level. Next, we gather logic DC paths, meaning proper sequences of DC explications beginning on level-I going down to level-III. We thus identify patterns in DC-to-DC interrelations. Last, we explicitly state what DCs on level-III AWS addresses, why and how (Miles et al. (2013)).

DC paths

Graph 10 illustrates the connectivity of all level-III-DCs. Closely connected DCs are Sense 7, Seize 16, Sense 1, Seize 1, Seize 3 and Seize 5. Medium connected DCs are further Sense 3, Sense 8, Seize 11, Sense 2, InnoSpeed 5 and Seize 7. Low connected DCs comprise InnoScope 3, Seize 8, Seize 17, Seize 23, Transform 5 and Transform 6.

The connectivity could be again a proxy for the importance for the specific level-III- DC.

Figure 30 reveals the explicit DC paths. We analyze each DC-to-DC path separately.

1. Externally identified innovations, customer needs and trends are intensified by customer and complementor network effects as well as specific customer focus. While more and more companies see benefits in moving their business to the cloud they build an innovation ecosystem with AWS. AWS directs its sensing, development and innovation capabilities towards these (potential) customers to deliver more value to them.
2. Once AWS has innovated solutions that could deliver more value to the customer, the business model gets redesigned, once again strengthening the network effects. Decisions at AWS have highly analytical foundations but are nonetheless concentrated on delivering the most value to the customer (e.g. AWS keeps low margins at all time by targeting on high volume sales). Continuous learning in sensing and seizing capabilities is used to scope the customer needs. Analytics applied on operations and customer behavior help to identify root causes of problems and mistakes and support the learning process.
3. Innovative service models that benefit large customer markets are sensed and directed. The customer is the initiator and starting point.
4. AWS uses a thorough customer understanding to target its markets.

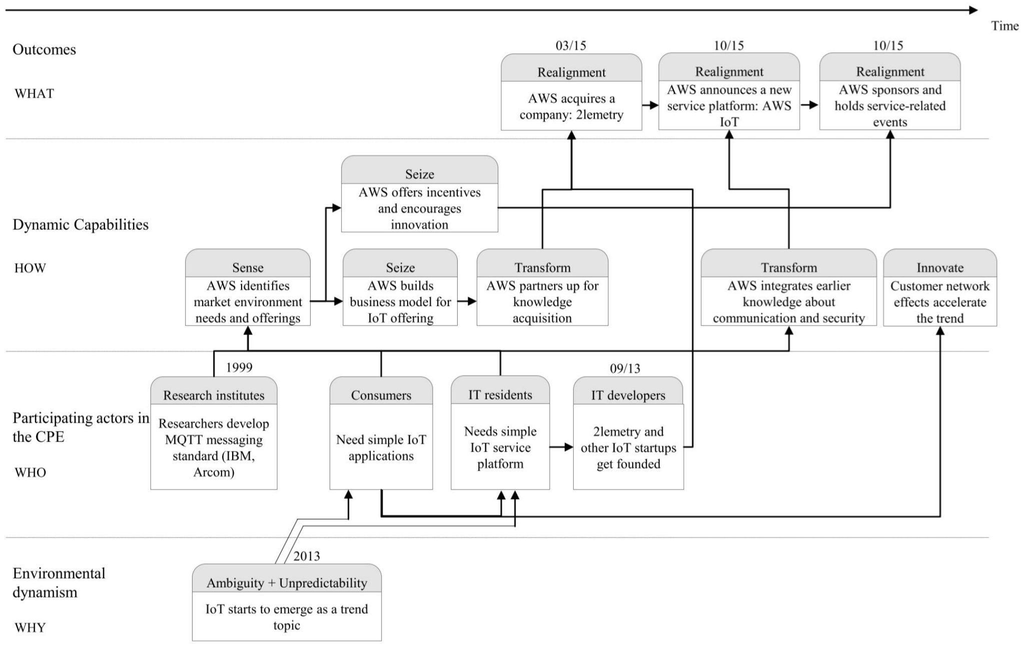

Figure 24: AWS-Roadmap for the internet-of-things trend

5. AWS adopts to the customer scope in order to gather experience and learn.
6. Sensing external innovation and directing internal innovation need to be done quickly. Customers and complementors need to adapt to the changing service platform. Open innovation is one driver to cope with this challenge.
7. Business model adaptions based on a changed service portfolio have to be executed in fast pace.
8. Improving the speed of the learning process is crucial.
9. External and internal innovations define the adoption of the business model (service portfolio, pricing, volume, cost structures, profitability, partnerships and target markets)
10. External, internal and open innovation are highly connected with soft factors of the platform firm, such as creative thinking, flourishing culture, leadership and value-drivenness. AWS's culture is extremely innovation-driven and open for experimentation.
11. Customer needs and technical feasibility lead to open innovation, and loosely coupled service structures (organizational and technical). The resulting innovation processes are open. Incentives are carefully considered through cultural composition.
12. Gathered understanding of changes in the market (customer needs, market trends and market segments) will be used to adapt the business model.
13. Market changes influence the decision making processes and cultural commitment of AWS. Development processes start at the customer without any fear of revenue cannibalization. Developers are free to choose what tools they need to satisfy the customers, but are forced to take care of the operations.
14. AWS makes tremendous use of analytics to check strategic and operational performance. Direct communication and conflict resolution is preferred over bureaucratic reporting.
15. AWS learns how to drive innovations faster that directly address the customer needs.
16. Changes in the business model directly influence the way the service portfolio is transformed. Essential for this transformation is the open innovation concept that includes the co-design (co-creation) of services by partners. Loosely coupled- structures help to steadily reconfigure and integrate services.
17. Profound knowledge about the market is crucial.
Loose service composition supports steady re-composition and re-offering leading to revenue cannibalization.
18. AWS learns about creativity mechanisms in order to innovate faster. Further learning supports the working culture at AWS.
19. Strong and thorough communication influences the incentive design. This leads to unbureaucratic processes to steadily realign operational and strategic decisions.
20. Enterprise boundary management and platform control leads to freedom in co- specialization, innovativeness and modularity. At AWS the strong partner management and legal protection enable its open innovation strategy.

DC explications

In the following explications of dynamic capabilities in cloud platform ecosystems for each DC microfoundation we first

Dynamic Capability (Level-III)	DC Code	Cloud platform provider AWS	Cloud recipients	Cloud partner ecosystem	Governmental Bureaucrats / Policy Makers / Regulators	Outside innovators / Research institutes	Entrepreneurs / Investors	Competitors	SUM	AVERAGE
Sensing external innovation	Sense 1	3	3	3	-	3	2	-	14	2,8
Sensing internal innovation	Sense 2	2	2	-	-	-	-	-	4	2,0
Encouraging open innovation focused on a broad external base	Sense 3	2	2	-	-	-	-	-	4	2,0
Sensing external R&D	Sense 4	2	2	-	-	2	-	-	6	2,0
Sensing internal R&D	Sense 5	2	2	-	-	2	-	-	6	2,0
Identifying market segments	Sense 6	3	3	3	-	-	-	-	9	3,0
Identifying changing customer needs	Sense 7	3	3	3	-	3	-	1	13	2,6
Identifying and evaluate ecosystem and industry trends	Sense 8	2	2	2	-	2	-	1	9	1,8
Using analytic frameworks to sense opportunities and threats	Sense 9	2	2	-	-	-	-	-	4	2,0
Selecting technology/feature and product/service architecture	Seize 1	2	2	-	-	-	-	-	4	2,0
(Re-)Designing revenue structures	Seize 2	3	3	3	-	-	-	1	10	2,5
(Re-)Designing cost structures	Seize 3	3	3	3	-	-	-	1	10	2,5
Selecting target customers	Seize 4	2	2	2	-	-	-	-	6	2,0
Designing mechanisms to capture value	Seize 5	2	2	2	-	-	2	1	9	1,8
Designing partnerships	Seize 6	3	3	3	-	-	-	-	9	3,0
Having deep market and customer understanding	Seize 7	2	2	-	-	-	-	-	4	2,0
Recognizing inflexion points	Seize 8	1	1	-	-	-	-	-	2	1,0
Avoiding and mitigating decision errors	Seize 9	3	3	-	-	-	-	-	6	3,0
Avoiding anticannibalization tendencies	Seize 10	1	1	-	-	-	-	-	2	1,0
Encouraging creative thinking and action	Seize 11	2	2	2	-	2	2	-	10	2,0
Encouraging removal of no value-adding assets and activities	Seize 12	1	1	-	-	-	-	-	2	1,0
Learning from mistakes	Seize 13	3	-	-	-	-	-	-	3	3,0
Demonstrating leadership	Seize 14	3	-	-	-	-	-	1	4	2,0
Communicating effectively	Seize 15	3	3	-	-	-	-	-	6	3,0
Recognizing non-economic factors, value and culture	Seize 16	3	2	-	-	-	-	-	5	2,5
Calibrating asset specificity	Seize 17	1	-	-	-	-	-	-	1	1,0
Arranging alliances to learn and upgrade	Seize 18	2	-	2	-	-	-	-	4	2,0
Deciding and managing integration, outsourcing and insourcing	Seize 19	3	3	3	-	-	-	-	9	3,0
Controlling bottleneck assets	Seize 20	1	-	-	-	-	-	-	1	1,0
Assessing legal and natural protection through an appropriability regime	Seize 21	2	2	2	-	-	-	-	6	2,0
Recognizing and managing complementarities	Seize 22	2	2	2	-	-	-	-	6	2,0
Recognizing, managing and capturing co-specialization	Seize 23	1	1	-	-	-	-	-	2	1,0
Learning	Transform 1	3	-	-	-	-	-	-	3	3,0
Transferring knowledge	Transform 2	2	2	2	-	2	2	-	10	2,0
Integrating know-how	Transform 3	2	2	2	-	2	2	-	10	2,0
Achieving know-how	Transform 4	2	2	2	-	2	2	-	10	2,0
Protecting intellectual property	Transform 5	2	2	2	-	-	-	-	6	2,0
Managing strategic fit so that asset combinations are value-enhancing	Transform 6	2	-	2	-	-	-	-	4	2,0
Developing integration, coordination and reconfiguration skills	Transform 7	3	3	3	-	-	-	-	9	3,0
Adopting loosely coupled structures	Transform 8	3	3	3	-	-	-	-	9	3,0
Embracing open innovation	Transform 9	3	3	3	-	-	-	-	9	3,0
Achieving incentive alignment	Transform 10	2	-	-	-	-	-	-	2	2,0
Minimizing agency issues	Transform 11	1	-	-	-	-	-	-	1	1,0
Checking strategic malfeasance	Transform 12	1	-	-	-	-	-	-	1	1,0
Blocking rent dissipation	Transform 13	-	-	-	-	-	-	-	0	-
Customer network effects	InnoScale 1	3	3	-	-	-	-	-	6	3,0
Complementor network effects	InnoScale 2	3	-	3	-	-	-	-	6	3,0
Information-based decision making and applied analytics	InnoScale 3	3	3	-	-	-	-	-	6	3,0
Modular product and service architecture	InnoScale 4	3	3	3	-	-	-	-	9	3,0
Information and technology functionality and exchange	InnoScale 5	2	2	2	-	2	2	-	10	2,0
Customer scope	InnoScope 1	2	2	-	-	1	1	-	6	1,5
Complementor scope	InnoScope 2	3	3	3	-	-	-	-	9	3,0
Information and technology appliance to multi-industry ecosystems	InnoScope 3	1	1	-	-	-	-	-	2	1,0
Customer attraction rate	InnoSpeed 1	1	1	-	-	-	-	-	2	1,0
Complementor attraction rate	InnoSpeed 2	1	-	1	-	-	-	-	2	1,0
Customer adoption speed	InnoSpeed 3	1	1	-	-	-	-	-	2	1,0
Complementor adoption speed	InnoSpeed 4	1	-	1	-	-	-	-	2	1,0
Platform adaption speed	InnoSpeed 5	1	-	-	-	-	-	-	1	1,0
Information and technology for open innovation and community	InnoSpeed 6	3	3	3	-	-	-	-	9	3,0
	SUM	124	98	70	0	23	15	6	336	48,0
	AVERAGE	2,1	2,2	2,4	-	2,1	1,9	1,0	5,7	

Figure 25: Intensity of dynamic capabilities and cloud platform ecosystem actors

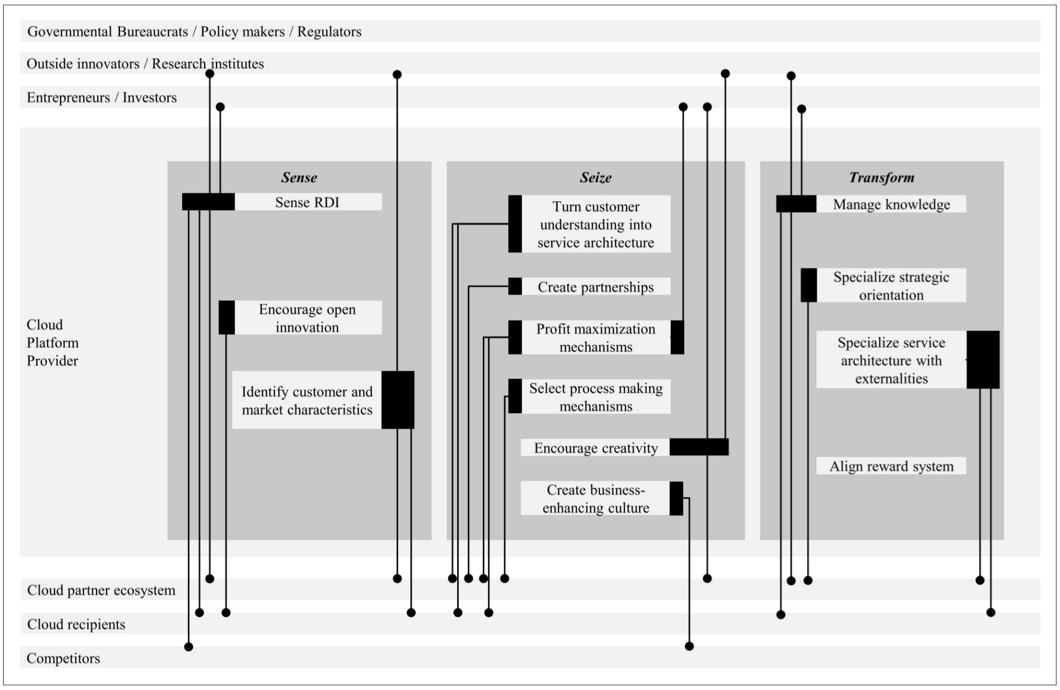

Figure 26: DC interrelations of CPPs towards CPEactors

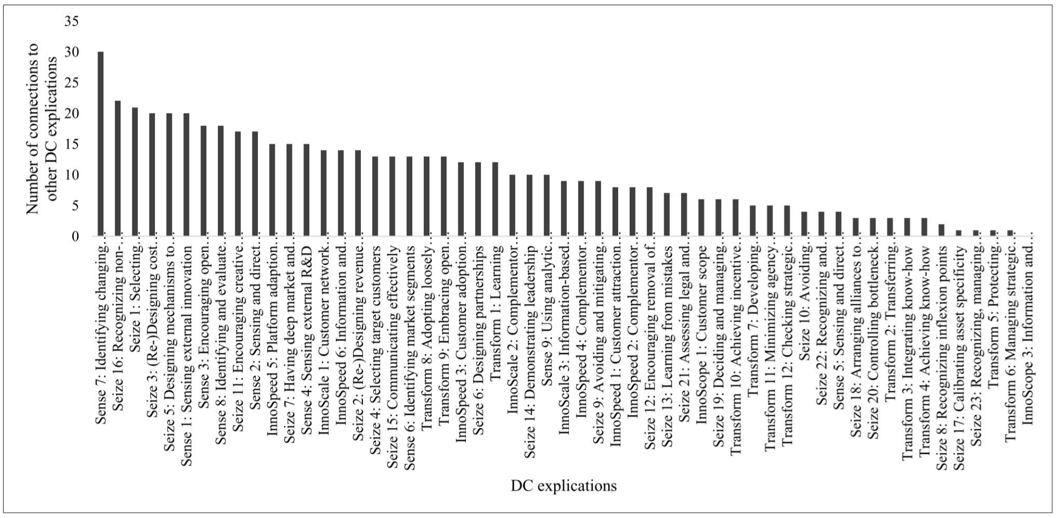

Figure 27: Connectivity of DCs (# Connections per DC explication towards other DC explications)

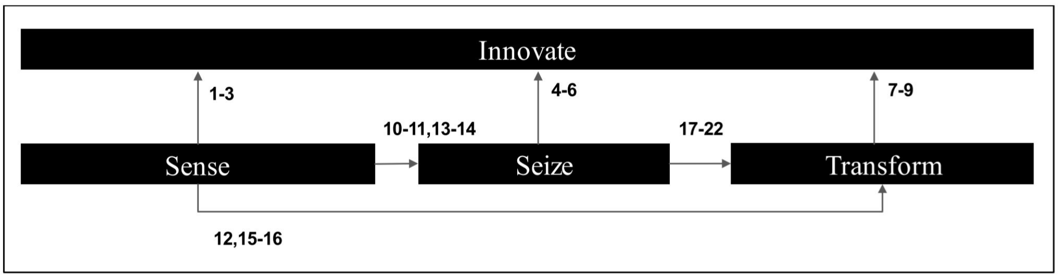

Figure 28: Dynamic capability level-I paths (with number declaration for explanation)

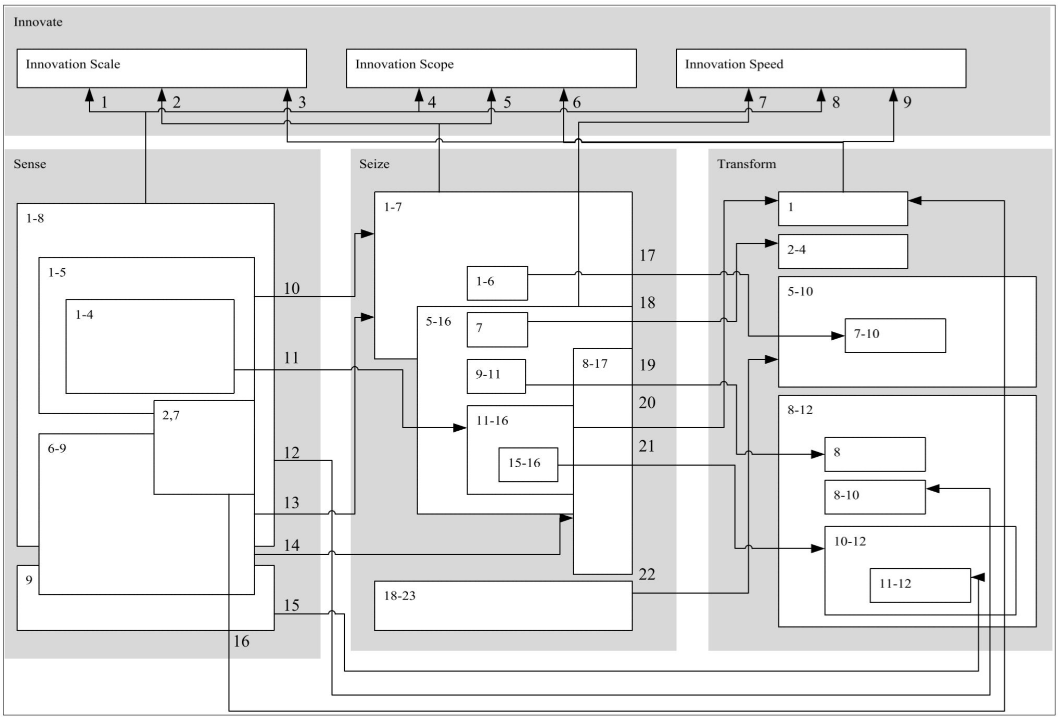

Figure 29: Dynamic capability level-III paths (number declaration inside white boxes as DC explications; number declaration on grey ground for explanation)

outline the "What"-factor. After his we explain "Why" and "How" the DCs are developed and expressed. For each DC microfoundation (Level-III) we thoroughly exhibit the explicit explanation. Furthermore, according to the prior identified focus fields (directions from chronology) we align the explications and include meaningful quotes. At the end of a explication you find the case study database reference code (for the original quote see Appendix A4).

DC explications - Sense

Sense 1 - Sensing external innovation

> "In fact, our customers are telling us that new ideas are now coming from across the organization and that employees are excited to innovate on behalf of their customers." (Andy Jassy, 2013, allthingsdistributed) (46:1)

AWS senses client innovations (6:1)(23:4)(40:4)(40:5). Furthermore, it identifies the customers' ways of developing (agile, continuous delivery, continuous integration and deployment, devops) (6:2)(12:1). AWS promotes ideas of innovators in the marketplace to see whether their ideas are valid. This reduces the risk for potential investors (23:3). Additionally, AWS understands that speed is crucial in external innovation (33:1). AWS recognizes change in innovation governance leading to innovations that come from employees across the firm (46:1). AWS senses deep needs of their customers regarding innovation and turn this into products (46:5). Moreover, it senses that customers want to become part of the larger ecosystem (55:3)(58:3). AWS recognizes when innovations are made around a specific technology (58:3). It senses that if all external innovation is connected through a platform a network effect is the consequence (66:1).

AWS senses external innovations in order to share common entrepreneurial spirits (6:9) and encourages customers' innovativeness and creativity (20:3). They do this because so they can offer the reliable and highly available cloud with that employees at firms can innovate (23:2).

AWS hosts a variety of community events like AWS Global Summit Series (6:5) or AWS City on a Cloud Innovation Challenge (6:6)(6:7). Furthermore, they manage the community like APN (Amazon Partner Network) (6:5) including partnerships with consulting and technology partners (6:2)(6:10) as well as cloud innovation center (6:8) and dialogues (46:1)(46:5).

Sense 2 – Sensing and directing internal innovation

> "If you want to block innovation and new ideas, you have to do the work. If you are the one that say 'this is not going to work' then you'll have to write a four or six page report [explaining] why absolutely you think the company should not be doing this. Believe me, this kills about 99 percent of all the objections to any innovation." (Werner (2015), Thenextweb) (88:4)

AWS innovates in high speed, leading fastly to new features (23:5). Furthermore, AWS innovates and loves it; they don't innovate only through acquisition (23:6). The AWS culture is designed to strive after new capabilities that could lead to new services (23:27). AWS aims to increase its innovation speed all time (25:1) and claims innovativeness to be in line with customer focus (53:1). They even claim innovativeness to be more important than administration in the first development phase (55:2). AWS aligns internal innovation strongly to the customer (89:1). Additionally, it innovates on top of open technologies when it recognizes its meaning for customers (58:5).

AWS gets chosen by cloud recipients because of its innovativeness. As environments are very dynamic, cloud recipients need a highly dynamic cloud provider (9:24). Moreover, AWS wants to stop any criticism to any innovation (88:3)(88:4). AWS manages structures to be diverse and heterogenous (88:5).

Amazon diversifies into various different verticals and markets (88:2). It encourages innovation in such strong sense, that innovation critics and blockers have to write full reports to state why they think a specific idea is not worth it (88:3)(88:4). AWS does not employ specific innovation or research staff/department, rather every team is told to innovate (88:1). It organizes teams that are in charge for the reliability and the innovativeness of a service at once (55:1).

Sense 3 - Encouraging open innovation focused on a broad external base

> "We chose Hadoop for several reasons. First, it is the only available framework that could scale to process 100s or even 1000s of terabytes of data and scale to installations of up to 4000 nodes. Second, Hadoop is open source and we can innovate on top of the framework and inside it to help our customers develop more preformat applications quicker. Third, we recognized that Hadoop was gaining substantial popularity in the industry with multiple customers using Hadoop and many vendors innovating on top of Hadoop." (Werner (2015), odbms) (58:5)

AWS bets on rather open technology and service contracts rather than closed ones, like many other providers do (59:6). Customers innovate on top of AWS and offer the resulting tools to the community (68:12).

AWS for example does this through its AWS marketplace for a network of third-party software vendors (64:1).

Sense 4 - Sensing external R&D

> "Eli Lilly is doing collaborative drug research using external researchers who collaborate over AWS" (Werner (2015), computerweek ly) (57:2)

AWS senses academic and research groups worldwide in order to find out whether a service that is under development needs certain technology (53:27). Furthermore, AWS senses that academia cannot fulfill innovative tasks at the pace AWS requires it, so interactions are limited (53:28). AWS recognizes that researchers collaborate over AWS (57:2).

It does not need to build the helping technology from scratch (53:27).

Sense 5 - Sensing and directing internal R&D

> "At Amazon, we're quite different from other companies. We do not have an R&D department, we do not have an IT department, all our engineering and business are deeply intertwined with each other. There is no VP of Innovation. Every team is charged with innovating, and that's what the whole company drives on." (Werner (2015), Thenextweb) (88:1)

AWS staff in development positions report boring tasks, but rewarding future job ops (17:2). At the beginning AWS was very bad at having a feeling for project durations (23:28). Developers working for AWS are free to use any development tool (53:24). New ideas get in prototyping mode very fast (53:26). Internal R&D at AWS is very close to the external R&D (53:27)(53:28). The development at AWS is very customer- oriented (55:10). There is no R&D department (88:1)(88:2).

AWS recognizes and directs internal R&D in order to understand the business problem (53:26).

They continuously iterate further solutions after the first prototype (53:26). Everybody has to participate in innovating and developing (88:1)(88:2).

Sense 6 - Identifying market segments

> "Every imaginable business segment is using AWS in a meaningful way," (Andy Jassy, 2014, Seattletimes) (25:2)

AWS targets market segments (2:8). AWS identifies and understands market segments, customer bases and verticals in its industry (53:1). It selects products and services based on these market segments (2:11). Furthermore, it defines product requirements based on confidential knowledge about specific market groups (2:12). Also within the services AWS identified there are specific customer segments based on their service user behavior, e.g. S3 (7:10). AWS is aware that new market segments where they have no experience yet could be troublesome (13:2). AWS knows that it may not benefit from first-mover advantages in some markets because of their lack in operations in those regions (13:3). AWS senses that the cloud market is growing because more and more customer segments come to the cloud (23:7). Today every business segment uses AWS in some sense (25:2). Tackling midsize and enterprise markets is important for AWS (42:1). AWS's services are focused towards a huge variety of market segments (46:3).

This creates awareness and increases the service adoption (2:10) in order to specifically target these markets (2:12). AWS aims for growing market segment shares (2:15).

Campaigns are created to target markets (2:10). AWS hires "Global Segment Leaders" for specific market segments, e.g. DevOps (2:14). It hires "Enterprise Field Marketing Managers" that are oriented towards specific market programs (2:20). AWS identifies ISVs that are leaders in their specific market segments in order to integrate them as partners (6:12). APN competencies are managed to identify market groups (7:4)(7:5).

Sense 7 - Identifying changing customer needs

> "Our customers set the roadmap." (Werner (2015), recode)
> "If we don't offer all the functionality that they want now, we're able to listen and quickly add what they want." (Andy Jassy, 2013, allthingsdistributed)

AWS gathers customer requirements (2:100). It develops customer relationship abilities (2:99). AWS "works backwards" from customer needs to products (13:43). AWS is aware that they may not be quick enough to adapt to the quickly changing customer needs (13:44). Already at the beginning AWS thought about the decomposed initial service offering consisting out of three separate service solutions (a computing service, a storage service and a database solution) (23:15). AWS compares its capabilities for changing customer needs to those of competitors (existing solutions) (23:29). AWS senses that smaller companies/projects and startups empowers them to grow and change their needs (30:4). AWS has a very positive attitude about ideas that address changing customer needs, they always try to say "yes" (46:6). AWS uses a direct customer feedback loop to the developer that develops and operates the service (52:2). AWS measures and analyzes customer behavior (also from a human perspective) before and after a new feature is introduced (53:6). AWS's roadmap is set by customers (61:1). Bringing together a set of changing customer needs again and again helps AWS to leverage huge network effects (66:1).

AWS wants to develop dynamic capabilities, because existing skills can become outdated, although the new steps might be tough (14:43). AWS encourages partners to be agile about changing customer requirements; customer feedback is essential when markets change quickly (6:41). It identifies changing customer needs by analyzing customer feedback and usage patterns (8:6).

Sense 8 - Identifying and evaluating ecosystem and industry trends

> "...understand [...] trends in the IT industry (e.g., CI/CD, IoT, Predictive Analytics)..." (job responsibilities of an IT Transformation Consultant at AWS) (2:30)

AWS's service offer is a combination of various service offers for multiple industries (1:1). Trends for the cloud partner ecosystem identified by AWS are: 1. Cloud Migrations 2. Cloud Managed Services 3. DevOps 4. Big Data 5. Internet of Things (IoT) 6. AWS for Windows 7. Embrace New Software Delivery Models. AWS senses how competitors respond to the trends (esp. cloud computing) (23:8). AWS senses industry-specific trends, e.g. automotive (37:1). AWS senses trends out of customer focus (58:2). AWS senses that network effects build up trends (66:1). It senses customer business behaviors, e.g. SaaS offerings on top of AWS from ISPs (68:8).

Industry trends get identified and evaluated in order to reduce costs, guarantee continuous delivery, exploit opportunities and reduce risks (2:25).

AWS forecasts industry trends (2:21). AWS needs to be aware of current and future industry trends (2:22). At AWS industry trends get communicated directly to the leadership (2:28). AWS discusses and evaluates trends with partners to leverage their success (6:13)(6:14).

Sense 9 - Using analytic frameworks to sense opportunities and threats

> "Using our business intelligence platform, we also drive complex data analysis to understand customer behavior, and to find hidden patterns in data that will help us design future products that customers will love." (job description of a Java/C++ Software Engineer at AWS) (2:97)

AWS has its own data analytics team and data analytics platform. They monitor and analyze data to improve customer experience. Data scientists and engineers help with their expertise (2:110). AWS uses business intelligence, big data, machine learning, statistical analysis, data mining and forecasting excessively (2:110). AWS analyzes its risks (13:5). Their meetings about operational performance are very data-driven. A lot of business metrics are analyzed and the business is reviewed. This directly leads into decisions. These meetings can be tough for the presenters (34:4). AWS makes economic analyses, strongly focused on free cash flow (48:1). AWS strongly analyzes customer human behavior (53:6).

AWS wants to understand customer behavior, find hidden patterns and ultimately shape future services based on this (2:97).

DC explications – Seize

Seize 1 - Selecting technology/feature and product/service architecture

> "Customers are telling us what they want, and that drives a lot of what we put on the roadmap. And I think you'll see us adding capabilities for companies with large data sets that want to do computing and processing, and then make that data useful." (Andy Jassy, 2013, Allthingsdistributed) (46:5)

AWS selects the technology, features and the service architecture based on customer data (2:97). AWS wants services that are loved by the customers (2:97). AWS is aware that its service portfolio is crucial for its success (20:2). AWS build its innovations based on customer needs (46:5), even if it lowers prices or cannibalizes other services, e.g. Glacier that is a far cheaper storage than S3 but with higher latency (23:13). When building a service structure, AWS decides what is best for the customer (23:15). It selects its service architecture by its value for the community (58:5).

New features are offered based on customer needs (12:19).

Seize 2 - (Re-)Designing revenue structures

> "We've lowered our prices 12 times in the past 5 years with no competitive pressure to do so." (Werner (2015), odbms) (58:6)
> "...sometimes we've done a price elasticity studies, and the answer is always we should raise prices. And we don't do that because we believe– and again, we have to take this as an article of faith– we believe by keeping our prices very, very low, we earn trust with customers over time, and that that actually does maximize free cash flow over the long term." (Jeff Bezos, 2013, hbr) (69:7)

AWS encourages partners to increase their revenue especially with cloud services (6:15). 3rd party sellers can offer and monitor their sales on AWS Marketplace with AWS Marketplace Metering Service for 3rd party sellers (6:16). It charges its computing/storage and networking services as well as certifications/trainings/boot camps (6:17). AWS offers a pay-as-you-go model (12:4). AWS offers tools for customers to calculate/anticipate their expected monthly costs (AWS Simple Monthly Calculator) (12:5). AWS offers a variety of pricing components for services, so not only one dimension (e.g. Amazon S3 has three pricing components: storage (per GB per month), data transfer in or out (per GByte per month), and requests (per thousand requests per month) (12:6)(12:7). It reduces prices regularly, often without competitor pressure (13:6)(44:7). AWS's customers highly value the often unannounced price cuts (44:8). AWS offers new services that offer different (for different purposes better) cost- effectiveness (13:7). AWS consults customers how to safe money using other AWS services, resulting in less revenue for AWS (Trusted Advisor) (13:8). AWS has always excess capacity (due to the nature of cloud computing), but sometimes even if they have too low utilization, they offer their services for special prices to maximize revenue (21:2). AWS builds its service infrastructure for maximum utilization, but is only able to charge the average; because of average customer workloads (85:4). AWS is confronted with price pressure from Google and Microsoft (22:1). AWS and the other big players often reduce prices in close sequence in regard to each other (23:10). AWS does not care solely on revenue e.g. with focusing their services to large enterprises; they also care about small and private customers (23:12). AWS is a business with high volume and based on its low prices also low margins (29:1)(43:4). Prices and costs are closely connected at AWS. Lower prices can be conveyed to the cloud recipient, because of lower costs (43:2). AWS sees their high-volume, low-margin business model as their strategic advantage (44:3). AWS recognizes its advantage in being good at managing operations for a high-volume, low-margin business, when competitors have to adapt and change (44:5).

AWS develops the partner revenue streams (50:1). AWS tends to improve its free cash flow per share, not the margins primarily (69:2).

AWS sees its business as a high-volume, low-margin business because of its long-term perspective (44:4). Although price elasticity studies advise AWS to increase prices, they lower them (69:7). AWS keeps prices low and lowers them regularly to build a trust relationship with its customers, which in the end should optimize their free cash flow (69:7).

Seize 3 - (Re-)Designing cost structures

> "We have so much scale that we're able to buy all the infrastructure at much lower prices and then pass those on at prices that are lower than what they do on their own." (Andy Jassy, 2013, wsj) (47:1)

AWS thinks in processes when cutting costs, e.g. reducing the end-to-end cost to send data packets (2:87). AWS thinks in infrastructure savings when cuttings costs, e.g. dedicated engineers to optimize cost-effectiveness of server infrastructure parts (85:2). AWS seeks both cost reductions and reliable services, e.g. with prioritizing projects (2:88), trend analysis and technology evolution (2:89). AWS uses industry cost models to assess supplier competencies and competition (2:90). AWS invests in partners and prioritize those investments (2:92). AWS board members do not receive much cash compensation (13:37). AWS invests with long term leadership orientation, rather short term profitability alignment (13:38). AWS realigns investments to favorable projects, after investment analysis (13:39). AWS makes rather big and worthwhile investments than small and futile ones (13:40). AWS informs the public ecosystem about major investments (13:41). AWS plans investments to increase in order to broaden the customer base (13:42).

AWS even takes out loans to invest (22:5). AWS expects to have at least one data center in each major country around the world, with different investment and cost structures (25:4). AWS data center costs highly depend on data center use (25:5). AWS explains its sustained long-term investments by the aim to reshape the entire industry (25:7). AWS's high investments can be seen as competition and market entry barriers (25:8).

AWS's depreciation cost is lower than its capital expenditure, but this only holds true for limited time: sooner or later growth is expected to decrease which will force the depreciation to come up to the capex level (28:6). Capital is spent in advance, because data centers have to be build up and equipped (35:1). In the early beginning of AWS, the investment into the data center led Amazon to build up AWS anyway, so it can be seen as very low risk investment (36:2). Low procurement prices, low investment and cost advantages due to economies of scale (for infrastructure) are forwarded to the customer (43:1)(47:1). Although AWS is very cost-effective (43:6), their costs are this high leading to low margin business (44:1). With the resources AWS invested in they are able to create the thriving learning curve, thus to create dynamic capabilities (78:11). AWS heavily invests in its cloud platform ecosystem, e.g. with conferences and co-marketing activities (79:6). AWS has high development and server infrastructure costs (79:7)(79:8). AWS allows to have low transaction costs for all ecosystem participants (79:9).

Seize 4 - Selecting target customers

> "Define and size target market segments, customer base, and key partners including ISVs and system integrators." (job responsibilities of a Business Development Manager at AWS) (2:96)

AWS's business is always driven towards target customer markets and realigned if the strategy changes (2:93). AWS's partners are supported to target market segments (2:95). AWS shapes and evaluates target customer segments (2:96). AWS's BI platform helps to select target customers (2:97). AWS offers the AWS Test Drive Program to partners so that they can target their customers (6:40). AWS's target customers e.g. developers and system architects, enterprise architects, auditors or risk and compliance professionals (12:16)(12:17)(12:18). AWS targets customer segments that can be innovate and flexible in business models with the help of AWS (40:2)(40:4). Most of AWS customers (number and computing usage) are large companies that try AWS and keep it (67:6).

This creates awareness and increases the service adoption (2:10). Campaigns are created to target markets (2:10).

Seize 5 - Designing mechanisms to capture value

> "The bottom line for pure cloud computing, which features scale, elastic pricing and agility, really comes down to server utilization and economies of scale" (Werner (2015), zdnet) (21:1)

As AWS builds a leadership position it creates means capturing value in terms of profit (13:9). AWS's low margins speak against high value capture (18:2). AWS's defends its strategy of low value capture against investors by arguing to look for free cash flow rather than for profit (22:3). It has to put into question whether AWS will ever start capturing value (22:6). It can be followed that most of the value created is directly given to the customer, because AWS creates a lot of value but does not capture it (23:25). Another value created for customers is simplicity and agility besides low cost (23:26), data security and governance (39:8). But in comparison to the retail branch AWS is able to capture much more value besides being even smaller in revenue (28:7). AWS needs to capture some value, which directly diminished the openness of the ecosystem (78:13). Optimizing the data center usage could help AWS to capture even more value (85:4).

Seize 6 - Designing partnerships

> "Develop long-term strategic partnerships in support of our key markets." (Responsibilities of an Acquisitions Manager at AWS) (2:105)

AWS works highly close with partners to reach and promote services (2:103). AWS seeks for long term partnerships (2:105). Inside AWS there are leadership partners (2:107). Comparably to customers, partners also deliver feedback to AWS, which directly leads to technology roadmaps (2:108). AWS also sees its customers as partners (13:46)(26:2). AWS's partners and customers teach a large amount of AWS related courses (46:9). AWS has technology partnerships with ISVs (49:2). AWS has partnerships with sellers that may add additional value to the services (59:2). AWS has partnerships with integrators and consultancies (59:3). AWS opens up its innovation mechanisms through partnerships (78:14).

A large and valuable partner ecosystem is needed for quick growth (34:5). Partners are valuable to reach business and enterprise customers (59:8).

Seize 7 - Having deep market and customer understanding

> "Our pace of innovation has been rapid because of our relentless customer focus." (Werner (2015), odbms) (58:2)

AWS highly understands customers (2:66). AWS wants to understand all customers, even private ones with small service use (23:12). Speed is essential for customers using AWS (33:1). AWS communicates with customers via blogs, forums and meet-ups as well as engages in open source communities to set the strategic product roadmap as well as to develop additional service libraries, applications and tools (2:66). AWS makes use of business intellige nce methods to understand the customer behavior and needs (2:97).

Seize 8 - Recognizing inflexion points

> "A large part of Amazon.com's technology evolution has been driven to enable this continuing growth, to be ultrascalable while maintaining availability and performance." (Werner (2015), acm) (53:4)

AWS recognizes that customer behavior and needs are going to change: from putting too much time into problem shouting into making great products (7:15). Amazon has gone through a huge inflexion point where it has built a very scalable, performing and always available infrastructure for its retail business. Offering this as a separate service to customers was a massive turnaround (53:4).

senseSeize 9 - Avoiding and mitigating decision errors "At Amazon - and especially in AWS - the leadership team is always trying to say yes. ... That has a big impact on the team. It encourages people to come up with new ideas that can help customers." (Andy Jassy, 2013, allthingsdistributed) (46:6) AWS carefully resolves all possible issues before launching a service (7:16). AWS differentiates between two types of decisions and manages them differently to guarantee low decision error rates: Type 1 (irreversible decision with no way backwards) and Type 2 (reversible decision). Type 1 decisions are made very carefully with high degree of methods, consultation and data-insight. Type 2 decisions are made very fast by expert managers or smaller groups. (13:19). If something of great possible value does not exist, AWS makes a quick decisions and develops it (23:14). If in doubt AWS decides from a customer perspective (23:15). AWS holds a culture where team members challenge each other intellectually in case of disagreement in order to come up with the right decisions (28:1). AWS carefully analyses its operational performance that help to make tough decisions (34:4). A further error could be to reject ideas to early, that is why AWS always tries to try out new ideas (46:6). AWS introduces prototypes and beta versions to the customer and quantifies its success (53:5) based also on human behavior statistics (53:6). AWS identifies what wrong decisions can result in (64:2).

Seize 10 - Avoiding anticannibalization tendencies

> "When things get complicated, we simplify by saying what's best for the customer? [...] In fact, sometimes we've done a price elasticity studies, and the answer is always we should raise prices. And we don't do that because we believe– and again, we have to take this as an article of faith - we believe by keeping our prices very, very low, we earn trust with customers over time, and that that actually does maximize free cash flow over the long term." (Jeff Bezos, 2013, hbr) (69:1)

AWS intentionally launches services that cost less than others of their own (13:7). AWS's culture of trying even endangers its retail business, as competitors can build up online retail stores on top of AWS that would compete with Amazon.com (13:10).

AWS has constantly cannibalized its business in order to satisfy the customer to the most possible extent (70:1).

Seize 11 - Encouraging creative thinking and action

> "Businesses often compromise on hiring characteristics in the name of rapid growth, but we're vigilant about hiring builders -inventive, entrepreneurial, creative types that want to operate what they build. We want missionaries, not mercenaries - people focused on building businesses that last beyond their tenure at the company." (Andy Jassy, 2015, medium) (23:17)

Creativity is a strong requirement for people working at AWS (2:33). AWS enables investors and innovators to test new ideas in the marketplace (23:3). AWS staff knows that its ideas are valued and offered to the customer (23:16). AWS strongly hires "builders" that not only invent but also operate their services (ideas) with long term perspective (23:17). AWS aims to innovate faster and faster (25:1). AWS could force the creativity so much that this leads to strong disagreement and unsatisfied workforce (28:2).

"Yes"-Sayers in management encourage creative work behavior (46:6). "You build it, you run it" could also hinder creative working (52:2). The whole AWS community is encouraged to think creatively (53:7).

The staff's creativity is used to solve problems (2.37) in order to develop unique joint value propositions as well as product strategies within an entire partner ecosystem (2:38).

The "exciting, dynamic and challenging environment" at AWS encourages staff to be, think and work creatively (2:34). The work environment at AWS is creative and excited to develop and create new services (2:35). Stock-based compensation helps to improve creativity (13:12). The development environment encourages the developers to think independently and creatively (53:8). But team creativity is also important (55:1).

Seize 12 - Encouraging removal of no value-adding assets and activities

> "Our team finds ways to move faster by cross training, process automation, removing non-value add activities, and improving quality." (Responsibilities of a Software Development Engineer at AWS) (2:45)

AWS removes non-value adding activities (2:45). AWS maximizes the value for the customer (34:7). AWS developers are responsible for the operation of a newly developed service, which directly maximizes value (52:2) and enables the company "to move faster" (2:45).

Seize 13 - Learning from mistakes

> "They don't make the same mistakes over and over. There is an implicit understanding that Amazon's leaders will be right far more often than they are wrong. If they do fail at anything, they are expected to learn from their mistakes, develop insights from those mistakes and share them with the rest of the company so the same mistake doesn't get recycled over and over." (John Rossmann, 2015, businessnews) (71:1)

AWS expects its developers to make mistakes and learn from them (8:1). AWS is not afraid of sometimes running into dead-end businesses (also because of mistakes), as long as some decisions turn out to be huge successes (13:11). AWS in general learns from its mistakes and success stories (13:20). AWS sees mistakes as investments into learning (13:40). Getting faster at innovation is another learning process for AWS (25:1). AWS leaders are expected to not make the same mistakes again and to be more right than wrong (71:1).

Seize 14 - Demonstrating leadership

> "To further clarify an idea, Amazon leaders also develop and articulate project vision statements in the form of "future press releases." A future press release is a short, simple and clear statement of how the project will be viewed if it achieves its aims and objectives. It is imagined this is what will be written once the project has come to fruition and as such will describe what was developed, why this is important to customers and what goals were achieved. (John Rossmann, 2015, businessnews) (71:3)

AWS leads the entire cloud computing industry (2:41)(80:1). AWS staff members need to have leadership traits (2:42). AWS changed enterprises attitudes about the cloud (6:22). When thinking about investments, AWS considers its resulting long-term leadership role (13:38). Competitors do follow AWS (18:3). AWS is leading the IaaS market and offers also PaaS services (19:2). AWS's leadership role could be positively affected as they don't separate development from operations (52:2). Based on its creativity AWS does build services that have never existed before and lead the cloud definition (53:10). AWS's innovativeness supports its leadership role (55:1)(55:2). Customers and customer network effects support AWS'S leadership role (61:1)(68:9).

Leadership over specific markets results in higher revenues, higher profits and ROIs (13:9).

AWS leads also by trying new things that were done completely different in the past, like low margin pricing as an IT vendor (18:2). To defend its leadership role AWS build natural barriers for new entrants, like massive datacenter investments and huge service portfolios (25:8). AWS's "future press releases" show how it is planning to maintain its leadership role (71:3).

Seize 15 - Communicating effectively

> "PowerPoints are not allowed at Amazon management meetings. Instead, leaders are required to write out their ideas in a two-page narrative. Then, at the beginning of the meeting, that two-page document is handed out and everyone sits quietly reading it before discussing the idea." (John Rossmann, 2015, businessnews) (71:2)

Talking with customers at self-hosted events (6:23). Showing transparency about compensation (13:12). Presenting strategic decisions about services as soon as possible to the public (13:41). Encouraging discussions in case of disagreements (28:1). Top management also is involved into smaller decision making processes to bring the service to perfection (34:8). When designing services AWS is very goal-oriented and applies "working backwards", thus creating an imaginary press release and FAQ document prior to writing application code. This helps to communicate clearly what to develop and what to expect (34:9). Effective communication also means to talk about inconvenient topics (34:10). Customer communication to AWS and among themselves is critical to understanding and service adjustments (34:11).

Unlike most companies AWS management discussions are not based on slide show presentation programs like Microsoft PowerPoint, rather the presenter has to write down his idea and overall message into complete text form. The audience reads the narrative quietly before discussion starts. (71:2).

Seize 16 - Recognizing non-economic factors, value and culture

> "Amazon is a place that really functions like a large startup. It is not slow and stodgy and bureaucratic, we move way more fast. It is a pioneering culture." (Andy Jassy, 2015, financial-times) (28:3)

AWS is very culture-driven and -defined (2:44): stock-based compensation (13:12), motivation (13:12), customer-orientation (13:12), e.g. customer value (13:15), service-ownership (13:12), cost-consciousness (13:14), excitement about fast adoption of new capabilities (23:19)(23:20), questioning disagreeing opinions (28:1), demanding culture (28:2), pioneering creativity (28:3) and innovation (46:2), performance evaluation based on hard metrics (34:4), no rest on success (34:12), combined responsibility for development and operations (52:2) and independence and small teams (53:10), first apps were focused on innovation side, not operation (55:2), ABKEHR from a strong orientation on financial results (like P/E ratios and value/EBITDA metrics) (64:4), anti- competition focused culture (71:2) and freedom to operate (53:14).

AWS cares about quality, lean processes and automated services (2:45), customer value generation (9:20), enabling customer innovation (9:22), strong partner network, fast growth (34:5), customer satisfaction (34:11), data protection, ownership and control (39:7).

Seize 17 - Calibrating asset specificity

Some AWS employees have highly specialized knowledge (2:46) and have highly generalized personality traits (2:47). The entire infrastructure that AWS invested in is highly specialized equipment, that can't be used for anything else but computing (21:3) and can be sold. A huge investment goes into the AWS as software parts that can be sold very difficultly (hyperspecialization) (85:3).

Seize 18 - Arranging alliances to learn and upgrade

> "Besides the big consulting partners and integration partners, we have established new partnerships with resellers that bet on our cloud offerings from the beginning on. (translated from German) (Werner (2015), channelpartner) (59:3)

AWS hires dedicated "Alliance Managers" to manage their alliances (1:4). Alliances can be seen as partnerships, too.

Those alliances are in line with business development and entrepreneurial skills (2:48). Strategic alliances also can cause problematic business situations, like business distraction, relationship disturbance, integration issues (13:16).

Seize 19 - Deciding and managing integration, outsourcing and insourcing

> AWS recognizes "the difficulty of integrating a new company's accounting, financial reporting, management, information and information security, human resource, and other administrative systems to permit effective management, and the lack of control if such integration is delayed or not implemented (investor information reports, 2015) (13:18)

AWS hires dedicated managers for integration purposes (1:5). Emergent technologies get quickly integrated (2:49). Several applications from ISV can be integrated into AWS (6:26). The integration of acquired technology or a company is difficult and can be costly (13:17)(13:18). System integrators are of high importance for AWS's strategy (49:3). The integration between AWS and other cloud services is very important and will become even more important (55:4). Challenges arise with integration, where an active community can support (56:2).

Seize 20 - Controlling bottleneck assets

Performance bottlenecks are addressed by technical and management staff (2:51). AWS actively addresses to get an understanding of performance bottlenecks (6:31). Although technical bottlenecks can be manifold, AWS has never experienced any outage of its entire infrastructure (11:4), e.g. one 5-hour outage in Virginia data center (28:4). AWS has optimized its connections between data centers (12:11). In many cases processes for data load and transformation tend to be the bottleneck (67:5). AWS focuses on cross-functional work (2:52).

Seize 21 - Assessing legal and natural protection through an appropriability regime

> "During and after the Term, you will not assert, nor will you authorize, assist, or encourage any third party to assert, against us or any of our affiliates, customers, vendors, business partners, or licensors, any patent infringement or other intellectual property infringement claim regarding any Service Offerings you have used." (Darrow, 2015, gigaom) (83:2)

AWS highly makes use of open-source technologies (use and contribution), that are legally open and not protected through paid licensing (2:50)(2:65). IP (intellectual property) is reserved through patenting (2:68). AWS is aware about the critical role of IP for its success (international domain names, trademarks, service marks, copyrights, U.S. and international patents, trade dress, trade secrets (13:21). Value of proprietary technology is captures through licensing. Mechanisms of legal protection may not exist in Non-US markets (30:3). AWS's service offerings are often combined with open- source products (55:5). AWS rejects any forms of vendor lock-ins for customers by providing very simple APIs, so there is no market protection at this side (56:4). AWS cooperates with other ISVs for licensing purposes (57:1). AWS's terms of business prohibit a customer directly to sue AWS or any of its affiliates (82:1). AWS's terms of business also prohibit any reverse-engineering, manipulation and modification of its services (83:1). Any assist, authorization or encouragement to assert legal infringement against AWS or one of its business partners are prohibited forever (83:3). With its legal terms in its terms of business AWS is highly defensive, and defends itself against customers that use their IP, without any resistance (83:5).

Seize 22 - Recognizing and managing complementarities

> "Amazon needs to build trust among such complementors, as they may fear that it would incorporate their products into the platform. To do this the company announces new features before they are released and discusses the roadmap with complementing firms. As the Amazon CTO, Werner Vogels, said: “We wanted to make sure people had a look at our roadmap, our goal is to be very respectful and recognize the value of the ecosystem”. (see appendix P79: Kolakowski_2009.pdf - 79:3)
>
> The large AWS ecosystem largely favors the customer to develop new applications, manage their cloud usage and get informed about new services (42:6). Complementarities: cloud enablers (auditors, brokers, additional-value service providers) (77:1). There is low platform lock-in for AWS complementors (79:1). Complementors offer higher level services (e.g. infrastructure management, monitoring and configuration management) to customers (79:2). AWS creates a trustful relationship with complementors and discusses the service roadmap in advance, because there is the risk that complementing services get directly integrated and replaced into AWS (79:3).
>
> AWS strongly differentiates itself from other platforms, making it costly for complementors to own more than one platform (79:4).

Seize 23 - Recognizing, managing and capturing co-specialization

AWS partners bring a set of capabilities into the cloud offering (8:4) that leads in its combination to hyperspecialization (85:3). Offerings of the AWS ecosystem seem to be highly co-specialized (e.g. integrated SaaS-solutions, AWS courses, consulting and integration services).

DC explications – Transform

Transform 1 – Learning

> "There's really no substitute for the accelerated learning we've had from working with hundreds of thousands of customers with every imaginable use case." (Werner (2015), odbms) (58:8)

AWS employees need to be quick learners and to be able to adapt to emerging technologies (13:1). AWS employees need to have interest in "playing" with new technology (2:55). AWS learns from successful business outcomes as well as from their mistakes (13:39). AWS considers failures as "valuable lessons" originating from investments (13:40). All ecosystem actors get informed about strategic choices, so they can learn about the outcome of this decision too, whether or not it gets continued (13:41). One learning was e.g. how to adapt to changing customer bond (first just service + APIs, later more coupling and transformation management (19:3). AWS continuously learns how to innovate faster and faster (25:1). AWS learns to understand customers and what they value (53:15)(53:16). Customer use cases are important for "accelerated learning" (58:8). AWS's investments in its learning processes and results characterize their dynamic capabilities. It learns about the markets, its resources, and organization to innovate upcoming services (78:11).

Transform 2 - Transferring knowledge

> "We found, though, that there had been some struggles with applying the concepts so we published the paper as feedback to the academic community about what one needed to do to build realistic production systems. (Werner (2015), odbms) (58:9)

AWS hires "Knowledge Management Librarians" for knowledge transfer and reuse (1:6). Engineers and developers at AWS are told to write and check knowledge transfer material (2:56). Knowledge is acquired at customer's side and directly leveraged for support engineering and support service teams (2:57). Knowledge is proactively shared within AWS (2:58)(2:59)(2:60) which directly evolves into a new asset (2:62). Knowledge is also transferred to external parties, e.g. through blogs, forums and meetups (2:66). A knowledge management system (KMS) provides the abilities to reuse, discover and enable knowledge. "Content Librarians" are responsible for the administration of the system (5:1). They plan, create, maintain and integrate the valuable content (5:2). Outside communities (like research institutes) are asked for feedback to specific technological challenges (58:9).

Transform 3 - Integrating know-how

> "Leverage knowledge of internal and industry prior art in design decisions." (job responsibilities of a Software Development Engineer at AWS)

Knowledge from external media sites (e.g. forums, blogs) and external research outcomes get integrated (58:9). Knowledge is integrated from internal staff to internal staff and from outside actors to internal staff (2:60). A lot of knowledge was originally integrated from Amazon.com (78:5).

Transform 4 - Achieving know-how

Know-how is achieved through hiring experienced staff (2:64). Know-how is achieved through working with customers closely together (2:66).

Transform 5 - Protecting intellectual property

AWS supports customers in legal challenges (12:13). Major competitors have more technology patents (81:2).

Transform 6 - Managing strategic fit so that asset combinations are value-enhancing

Partner offerings are combined with AWS services to increase customer value (8:4). AWS combines its role in cloud computing with chances in the IoT market (42:7). Hyperspecialization is one of the major reasons for AWS's increased success (85:3).

Transform 7 - Developing integration, coordination and reconfiguration skills

> "You will integrate a wide range of existing AWS infrastructure to deliver large-scale, high-throughput distributed services consumed by mobile developers." (job description of a Software Development Engineer at AWS) (2:70)

AWS requires its developers to have experience in continuous integration topics (2:69). AWS requires its developers to integrate ISV's systems into AWS (2:72). AWS is aware that the integration, coordination and reconfiguration of projects, systems and acquisitions is important for their success and could be difficult (2:80)(13:27)(55:4). AWS requires its staff to be able to reconfigure (2:76) and manage projects (2:80). Integration partners help AWS and its customers with the integration (59:3).

Transform 8 - Adopting loosely coupled structures

> "I think there are a number of standard principles that we can apply in terms of hierarchies, of loose coupling, of probabilistic techniques that I'm confident will serve us for quite a bit of time. When we developed these services, we were looking ahead in terms of what kind of scale we could achieve, and we're not there yet. Even then, I'm confident that the choices we've made were the right ones." (Werner (2015), informationweek) (55:9)

Loosely coupled structures are an essential part for AWS, from a technical and an organizational perspective (34:13) (53:22) (55:6) (55:8). Openness is congruent to the loosely coupled architecture (55:3).

Originally, the decoupling of communication APIs was needed to expose the communication interfaces to external Amazon.com retail partners (23:21)(55:6). SOAs helped AWS to develop more rapidly and independently (53:20). AWS is very organic from a development and operation perspective because of the SOA.

SOAs help AWS to be rigidly innovative. Less vendor lock-in for customers (56:4) and portability for customers; but this is not always simple as SaaS operations are not standardized (yet) (79:11). AWS encourages business partner collaboration (78:2).

AWS hires developers with experience in specific architectural patterns for loosely coupled structures (service oriented architectures) (28:1) SOAs were groundbreaking for AWS's business model (53:19).

Transform 9 - Embracing open innovation

> "[...] Amazon opened up its platform and ICT infrastructure through Web services. Secondly, it acts as an incubator for e-business. Thirdly, the

> company expands the use and finally the reputation of its platform thanks to Amazon certified integrators." (Isckia et al. (2009)) (78:4)

AWS developers are directed to learn and apply open source technologies (2:50). Open source code improvements are transferred back to the community (2:65). AWS collaborates with the open source community (2:67). AWS is open for everybody, even for competitors of AWS's affiliates (e.g. Netflix).

AWS's open innovation model consists also of supporting any AWS user to increase connectivity in (ICT) business ecosystems (78:1)(78:2). AWS's open innovation strategy is based on the offered web services, its incubator role and the platform actor architecture (certified integrators, partners, etc.)(78:4). Amazon's reputation helped to be rated as trustworthy among the ICT industry (78:5). AWS open innovation strategy can be described as a duality, where some actors exploit the knowledge and capabilities of the system and some other actors innovate with existing and new services (78:7).

Open technologies could help to resolve and move performance bottlenecks (2:50). AWS encourages to use open source software to reduce lock-ins at customer side and to give customers the freedom of deployment choice (14:2).

In its core AWS is based on open source technology (e.g. Xen Hypervisor) (56:3). AWS supports the open source community also with steadily low cost computing services (58:11). Cloud recipients develop on top of AWS and offer those tools to the open source community too (e.g. Netflix) (68:12).

Transform 10 - Achieving incentive alignment

> "When they wake up and are thinking in the shower in the morning, they're thinking about customers, and thinking about how to invent on behalf of customers, and they find that fun. And if you get here, and you find that you get your motivation from having a more competitive-focused culture, you might find our culture dull. We don't." (Jeff Bezos, 2013, hbr) (69:5)

Generally, incentives are designed to encourage long-term decision-making rather than short-term (13:35) - it is again customer-driven, not competitor-driven (69:4).

Incentives for developers for working at AWS are mostly based on cultural characteristics: demanding and exciting work experience (2:85) focused on customer experience (69:5), working with world-class computer scientists (2:85), working on interesting problems (2:85), certifications (12:14), some say it is boring but rewarding work (17:1)(17:2), although developers have low development restrictions, incentives are given to integrate their services with others (53:23)

Incentives for managers and the board: Leadership Development and Compensation Committee (13:33), no cash bonuses are provided (13:34), stock-based compensation for long-term performance alignment (shareholder value) (13:36), yearly election of the board, prevention of inside relationships, no anti-takeover mechanisms (64:5)

Incentives are also given to the platform ecosystem actors: start-up bonuses for new service launches (6:39), lower IT operational costs (6:37), certifications (12:14).

Transform 11 - Minimizing agency issues and Transform 12 – Checking strategic malfeasance

Strategic and operational issues are directly and openly discussed in an unbureaucratic way (34:4).

Transform 13 - Blocking rent dissipation

AWS does not need to block rent dissipation, as they don't manage depleting resources.

DC explications – Innovate

InnoScale 1 - Customer network effects

> "From an innovation point of view, quite a number of enterprises are considering moving some of their services into the cloud and then opening them up such that they can become part of the cloud ecosystem, making it easy for Company X to access their services in the cloud and third parties to extend the platform they're building." (Werner (2015), informationweek) (55:3)

AWS holds strong customer network effects and aims to intensify those (7:1). Cloud recipients move to other clouds if it makes economic sense; one economic reason can be when another company consumes or produces a lot of data from or for that company (67:4)(68:9). AWS's customer network increases with time, as more and more customers open themselves up into AWS to become part of the larger AWS ecosystem (55:3). The fact that it is efficient when code (algorithms) is near the data it is working on supports the network effect (67:1). Working on data creates more data that needs to be stored and maybe is consumed again (67:1). There do not exist any network effects between complementors and users (79:13).

For AWS it is important to gain competitive advantage and market share (64:8). With increasing network effects, ISVs probably support competing platforms less (65:1)

More and more customers get attracted because their business partners already have their data and services on AWS and they want to be close to these (67:2).

InnoScale 2 - Complementor network effects

No network effects between complementors and users (79:13). There are probably network effects between complementors, as they complete the service portfolio.

InnoScale 3 - Information-based decision making and applied analytics

AWS uses information-based decision making and applied analytics for pricing, customer targeting, investment decisions (2:91) and in order to understand customer behavior for the development of future products (2:97). Generally, AWS uses applied analytics in order to learn (13:39), forecast projects (23:38) and benchmark industry cost models

(2:90). A business intelligence platform supports the analysis and decision processes (2:97).

InnoScale 4 - Modular product and service architecture
AWS's modular structure is rather technical and can be identified in the service offering (34:13)(53:22). As already mentioned information technology has enabled and leveraged this service architecture (53:20)(23:21)

InnoScale 5 - Information and technology functionality and exchange
At a large scale information and technical knowledge is achieved, applied and distributed by technical experts (2:64). Non-technical staff reorganizes information for later reuse (1:6).

InnoScope 1 - Customer scope
AWS has a large and heterogeneous customer scope. It sets customer scopes for different industries (like healthcare, IoT, etc.) (40:4)(42:7), company sizes (like startups, large enterprises, etc.) (67:6)(23:12) and company departments (like HR, IT development, etc.) (13:18)(55:11). Since AWS's innovations are oriented towards customers the innovation abilities are manifold too.

InnoScope 2 - Complementor scope
AWS's partner network is large and heterogeneous too. The network members serve as an additional mean to serve and reach customers and to implement the customer feedback loop (2:79).

InnoScope 3 - Information and technology appliance to multi-industry ecosystems
AWS targets customers of different sizes in various different industries and branches (2:109). AWS continuously expands into a variety of industries and countries (4:1).

InnoSpeed 1 - Customer attraction rate
AWS has a high innovation speed that accompanies the customer attraction speed (rate) (20:2)(23:1). Already in 2008 AWS served 60.000 different customers (67:6). Since its launch in 2006 they attracted 2.500 customers per month for two years on average. 7 Years later in 2015 they already attracted over one million active users, resulting in an attraction rate for this time span of 11.200 customers per month. Thus, the customer attraction rate has been increasing tremendously and shows the strong notion of customer network effects. Also from this we can see that growth is essential for AWS (53:9).

InnoSpeed 2 - Complementor attraction rate
Innovation speed accompanies complementor attraction speed (rate) (20:2)(23:1). (We could not find any numbers that show the growth of the complementor network.)

InnoSpeed 3 - Customer adoption speed, InnoSpeed 4 - Complementor adoption speed and InnoSpeed 5 - Platform adaption speed
AWS applies quick innovation to transfer customer needs to services (23:1)(23:5). Quick adoption takes place through standardized APIs (34:2). (We could not find any information about the adoption time and speed.)

InnoSpeed 6 - Information and technology for open innovation and community
Information and technology gets distributed among the community that is oriented towards open innovation. Collaboration, exchange and transfer are executed with open source mechanisms and technologies (2:50).

5. Part IV: Discussion

In this chapter we discuss the previously obtained results in more detail. We describe the derived implications on research theory and management practice. Furthermore, we evaluate the quality of our study in respect of former research. We also express the limitations of this study that could be a motivation for further research endeavors.

5.1. Theoretical implications

RQ1: What specific dynamic capabilities do CPPs use within their ecosystem?

RQ1.1: What specific DC explications do CPPs use within their ecosystem?

AWS, as a flagship CPP, develops and uses all of the various microfoundations of dynamic capabilities (sense, seize, transform, innovate) in the ecosystem, except the blocking of rent dissipation (no management of natural resources). We conclude that AWS identifies, targets, selects and exploits research, development and innovation. It actively analyzes and selects the cloud platform ecosystem. Adjusting the business model frequently, gaining decision excellence, rewarding the work and customer culture as well as controlling and leading technology integration and progress help to seize former identified environmental changes. Finally, the management of CPE-wide knowledge, the setup of loosely coupled structures and the alignment of business ecosystems help to transform the seized changes into business-changing outcomes.

We could find some conceptual overlaps between "innovate"- and "sense, seize, transform"-capabilities, especially in InnoScale 3-Sense 9, InnoScale 4-Transform 8, InnoScale 5-Transform 1-4 and InnoSpeed 6-Transform 9. The dataset depth could not deliver a proper differentiation in these explications.

RQ1.2: What paths of DC explications do CPPs use within their ecosystem?

AWS uses the level-I-DC paths that are outlined by (Teece (2007)). They sense, seize and transform, in this order whereas there are also pure sense-transform paths. Additionally, we conclude paths that go from each of the three traditional dynamic capabilities stated by (Teece (2007)) - "sense", "seize", "transform" to the innovation capability ("innovate"). All in all the highly connective level-III-DCs build up 22 mutually exclusive and reoccurring paths. The general connectivity of level-III-DCs is evenly distributed - we see highly connective and sparsely connective DCs. Based on AWS's business model there are very common and presumably highly special paths like sensing RDI, building a culture around this for integration purposes and learn continuously from this.

RQ1.3: What trends are followed? Can we deduce and reconstruct roadmaps?

The chronology time series analysis and roadmapping showed there are truly trends highly connected with DCs. In this we have seen that popular trends like new service announcements, compliance and security, automation, and power/cost optimization are picked up. With the help of CPE actors DCs are developed and used in order to respond strategically to environmental changes.

RQ1.4: What intensity distribution among different DCs can we detect?

The DC intensity analysis implied that DCs are developed and used in different degrees. This holds true for separate assessments of DCs as well as connections with CPE actors. Highly intense DCs such as Sense 1 (Sensing external innovation) and Sense 7 (Identifying changing customer needs) verify prior DC outcome directions where we figured out that AWS is kindly obsessed with customer thinking and orientation. We could identify less intense DCs like Seize 17 (Calibrating asset specificity) and Transform 12 (Checking strategic malfeasance) too.

RQ1.5: To what extent can we verify former research? What can we add to the literature?

We can verify former research done by (Teece (2007)), so that microfoundations of dynamic capabilities are existent, developed and used. Furthermore, we could verify innovation platform properties (Venkatraman et al. (2014)) and found some overlaps with Teece's DC microfoundations. We added a large set of CPP-specific DC explications. Furthermore, we applied an intensity dimension to further mark out the focus DCs. We did not find any evidence for blocking rent dissipation, as this is maybe only suitable for companies that make use of depleting, nonrenewable resources.

We can verify the level-1-DC paths presented by Teece, but add a CPP-specific level- III-DC paths view. Furthermore, we identified highly connective DCs on level-III, such as "Sensing external innovation" and "Selecting technology/feature and product/service architecture". The identified paths clusters show that level-III-DCs are very connective within their level-I-DC group too.

RQ2: Why do CPPs use dynamic capabilities?

RQ2.1: Why do CPPs use specific DC explications?

From our findings we interpret that AWS applies DCs in its CPE generally with the goal of gaining further market share in all its segments. For this it needs competitive advantages. These are built upon a thorough understanding of customers. AWS learns from its customers, exposes to them, connects with them, builds trust and always refines its capabilities.

More specifically, AWS senses in order to understand customer behavior and encourage innovation as well as creativity at CPE actor site. Seizing happens because AWS wants to benefit from long-term free cash flows, joint value propositions and accelerated innovation. The followed transformation helps AWS to benefit from network effects, gained customer trust and encouraged collaboration in the CPE.

RQ2.2: To what extent can we verify former research? What can we add to the literature?

We can confirm all of the former research that has been addressed to investigate the reasons for developing dynamic capabilities (Wang and Ahmed (2007)). Long term market-based and financial performance are the main reasons for the development of dynamic capabilities, whereby we add the strong customer satisfaction and orientation component with this research.

RQ3: How do CPPs use dynamic capabilities?

RQ3.1: How do CPPs use specific DC explications?

Specifically, AWS uses a variety of processes, tools and mechanisms in order to develop dynamic capabilities. They master the management of entrepreneurial activities to drive an innovation culture that is clearly obsessed with satisfying customer relationships. Listening to trends, insights and metrics realigns the marketing efforts. This not only helps to drive reshaping decisions about the business model. Furthermore, it facilitates future-oriented and long-term contribution in the own cloud platform ecosystem. Knowledge management that is strictly directed towards the CPE, embraced network effects and reduced customer lock-ins help to succeed in the transformation phase.

RQ3.2: To what extent can we verify former research?

Former research about the specific DC-generating activities and processes for CPPs has not existed specifically. We can only verify former research from Isckia and Lescop (Isckia et al. (2009)) that specified the open-innovation-related DC building activities like strong support, collaboration and partnership-building within the CPE.

RQ4: With whom do CPPs use dynamic capabilities?

RQ4.1: What interrelations occur between CPPs and other actors within its ecosystem?

Along DC paths AWS interrelates to a variety of other ecosystem actors. Those are predominantly cloud recipients, partners and outside innovators (researchers). To some extent AWS also interferes with entrepreneurs and competitors.

RQ4.2: What intensity distributions among different ecosystem actors can we detect?

AWS uses dynamic capabilities with differing levels of intensity among the CPE actors. By far the strongest connection they build with cloud recipients and partners. Less intense links are built with investors and research institutes. DC-related orientations towards competitors hardly take place as AWS does not get its innovation drive from competitive pressure, but from customer insights.

RQ4.3: To what extent can we verify former research?

We can generally confirm the work of Mayevski (Mayevski, 2014) and Tsujimoto et al. (Tsujimoto at al., 2015). The prior cloud platform ecosystem synthesis occurs to be confirmed, because strong links to all the participants in AWS's ecosystem could be identified except for regulators. We investigated predominantly DC-related interactions. We can assume that AWS interferes with regulators and policy makers in more compliance-related activities.

RQ5: What outcomes caused by strategic responses of CPPs that are based on dynamic capabilities can be identified?

AWS has been using all strategic responses like exploitations, upgrades, realignments and extensions. AWS's announcements reflect a very strong notion of upgrade events.

This means they very often upgrade their already existing services to make them even more suitable for specific purposes, presumably always adapting their services to fully meet the customer requirements. Also, AWS extends their services very often, thus bringing services to new markets.

RQ5.1: To what extent can we verify former research?

From this point of view we can confirm Tsai's research about platform strategy responses. The various means of strategic responses to environmental changes in platform ecosystems have been identified, categorized and analyzed. More importantly we first apply this scheme to an actual real life case in the cloud platform domain and see the dynamics in this process through chronologies.

5.2. Managerial implications

The implications of the integrated framework and its successful application and analysis in the research setting of AWS should be of great interest for both practitioners in (cloud) platform companies and platform actors. The main contribution of this thesis to management practice lies in the identification of a cohesive set of drivers to stimulate the development of dynamic capabilities in CPEs - and thus long-lasting competitive advantage and financial performance. To facilitate lasting platform success, growth and leadership, this thesis postulates that it is central for managers of technology platforms to understand the control levers for the development of abilities for dynamic environmental change in a comprehensive manner.

5.3. An integrated framework of DCs within CPEs

Finally, we get to an integrated view about the explications of dynamic capabilities in cloud platform ecosystems. The symbiosis consists of all major theoretical and managerial implications.

5.4. Quality of the study

Quality in the domain of case studies

The quality of this study can rated as very high based on Yin's criteria for judging the quality of case study research designs. As we mentioned in chapter 5.1, good case study quality is based on the validity and reliability of the study. As shown in Figure 11, we fulfill all four categories to good extent. Thus, we can conclude that our results are valid because of a high research validity (Yin (2009)). We use data triangulation through a lot of archival data for construct validity (Gibbert et al. (2008)).

Quality in the domain of dynamic capabilities

In order to enhance the quality of this thesis we successfully diminish methodological quality issues some other work created in the past. The research field of dynamic capabilities generated a lot of attention and a few authors also have researched about the methodological quality issues some work holds (Hurmerinta-Peltomäki and Nummela (2006); Wang and Ahmed (2007); Barreto (2009); Eriksson (2013)).

Unlike DC research of inferior quality, we guarantee that the applied methodology is suitable for the certain field of DC research because we described the DC's microfoundations applied to cloud platform ecosystems in detail. Moreover, the transferability and reproducibility of our research is assured, because we justify all research design decisions. We include the whole life span of AWS. Thus we do not only use cross-sectional data. We only incorporate trustworthy resources into our case study database, e.g. we excluded forum entries. Our research is based on widely accepted DC measures. In this case the microfoundations of Teece are widely accepted. We include a lot of secondary data. This leads to a much more comprehensive view than primary data would deliver that only comes from managers. Moreover, using a mixed-method research approach leads to higher quality too (Hurmerinta-Peltomäki and Nummela (2006)).

We successfully incorporate quantitative data and create a multi-dimensional view on the DCs (e.g. actor-wise and time-wise) (Wang and Ahmed (2007)). We use a large variety of different analytic techniques. Our research is rather concentrated on an in-depth analysis than on cross-cases (Eriksson (2013)).

Quality in the domain of mixed-methods research

In the research field of mixed-methods research we increase the quality by having a clear and concise focus for the research purpose that could be gathered out of the conceptual frameworks. The research has always logic and sound explanations justifying the design and interpretation decisions. A suitable code book and detailed formulas for the quantification of qualitative data leads to higher grade of the study, too. Last but not least a proper generalization is successful (Bazeley (2004)).

5.5. Main findings

The present study was designed to analyze what, how and why cloud platform providers develop and apply dynamic capabilities in cloud platform ecosystems. The results confirmed the expected manifoldness of DCs developed by CPPs, while including many different CPE actors in order to gain competitive advantages, growth and financial profitability. The direction of analysis was led by strategic responses emitted by AWS in order to deal with dynamic environmental change.

All in all some of the obtained results were astonishing and unexpected. We did not expect that AWS announcements would fit so well into our chronology model that is based on strategy responses.All in all, AWS responded with all possible strategic actions: exploitations, realignments, extensions and upgrades. The announcement rate reflects the exponential financial growth of AWS (see Appendix B6 and B7). Although we thought to see much more realignment-focused strategy response mechanisms, the update-heavy responses reflect the tactical maneuvers of AWS better. This is because AWS continuously listens to customer feedback and immediately adapts the service configuration. That also could be an indicator for potential operational dynamic capabilities. Although the evidence showed that AWS is using a huge set of dynamic capabilities, we could not imagine that AWS is that much focused towards customers and

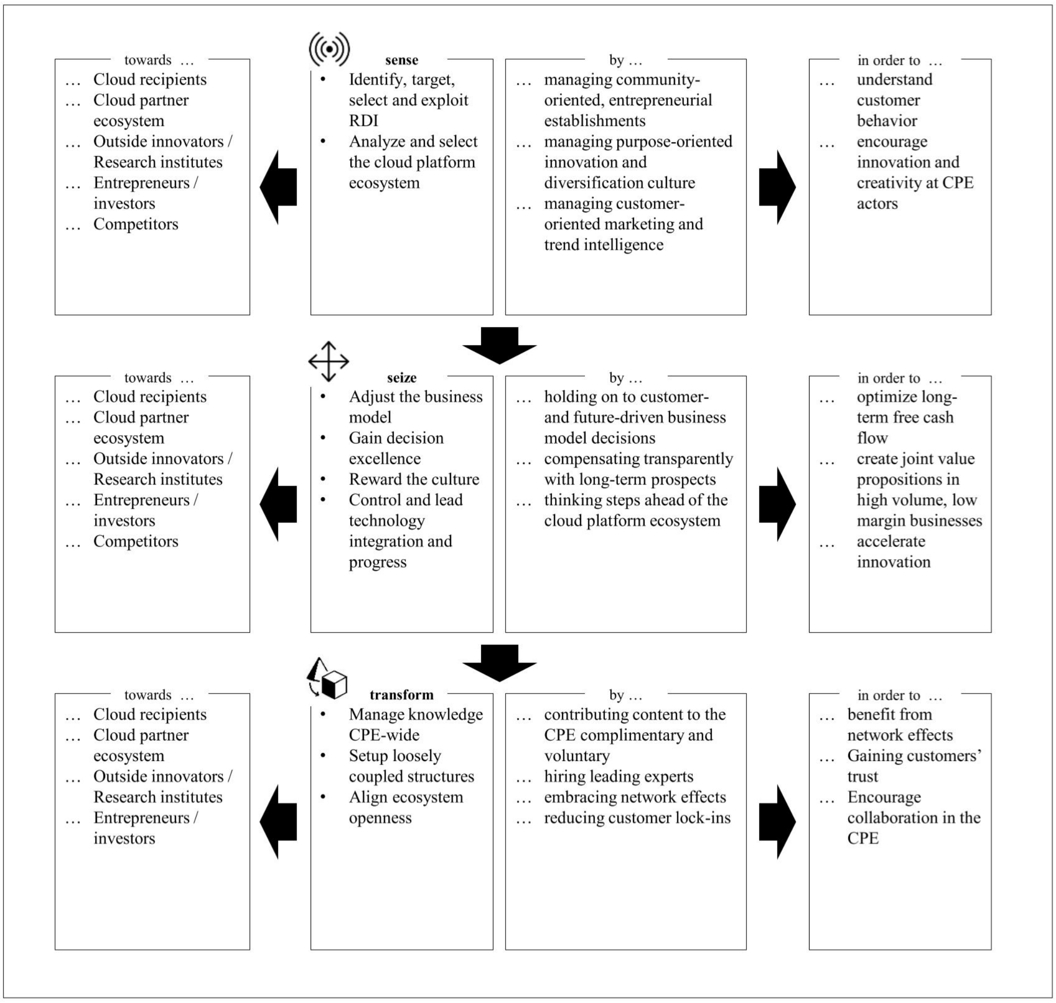

Figure 30: Theoretical and managerial implications for DCs in CPEs

partners. The roadmapping technique we applied on the IoT trend topic is suitable for the visualization of the interrelations of the dynamic capabilities with participating actors in the CPE, environmental dynamism and finally strategic outcomes.

The ecosystem is one of the crucial elements of their success. We could detect this in the network analysis consisting of actor intensity analysis and actor network interrelations. We expected AWS to have much more interrelations to e.g. competitors. In terms of dynamic capabilities AWS seems to have no connections to regulators. Interestingly, almost all dynamic capability groups in the network view are oriented towards external actors, except "aligning reward systems".

We could confirm the dynamic capability paths proposed by Teece (Teece (2007)), also we could figure them out in a much more fine-grained fashion. The dynamic capability explications helped to argue a variety of DC actions and reasons. Also, a few unexpected insights have been uncovered about AWS's explicit dynamic capabilities. The unconventional leadership and decision culture with its pragmatic, detail-oriented and optimistic culture surprised us further. All in all we did not expect these detailed results at the beginning.

5.6. Limitations and future research

Although, our research design led us to plenty of insights about the dynamic capabilities in cloud platform ecosystems, there are a few limitations that possibly restricted our insights. We find limitations in the literature review, in the methodology and in the case study. Removing the limitations leads to open questions that should be discovered in further research.

The literature review could have revealed a limited scope of research because of our deductive generation of research generation. Here we focused on an inductive approach. In some means we neglected to experiment, and rather concentrated on confirming known things in other research areas and allow the knowledge transfer. This is further acknowledged because we strongly focused on Teece's (Teece (2007)) and Venkatraman et al.'s (Venkatraman et al. (2014)) dynamic capabilities. One could argue that the dynamic capability levels are too generic and thus offer a limited level of investigation. The finalized research questions could not allow a very detailed investigation on operations level.

Table 12: Analytics methods overview

Test category	Case study tactic (based on Yin (2009), Gibbert et al. (2008))	Research section	Activity in this research
Construct validity	use multiple data sources	Case collection	Yes, fulfilled
	build sequences of evidence	Case collection	Yes, fulfilled
	adopt questions from former research in the same field	Case design	Yes, fulfilled
External validity	describe case firms' situation and context	Case selection	Yes, fulfilled
	apply cross-case analysis	Case analysis	No, further research should cover this
	Use replication logic in multiple-case studies	Case analysis	No, further research should cover this
	Use rival theories within single cases	Case analysis	No, further research should cover this
Internal validity	base research focus on conceptual frameworks gathered from literature review	Case design	Yes, fulfilled
	do pattern matching	Case analysis	Yes, fulfilled
	do explanation building	Case analysis	Yes, fulfilled
	do time series analysis	Case analysis	Yes, fulfilled
	do logic models	Case analysis	Yes, fulfilled
	use multiple information	Case collection	Yes, fulfilled
Reliability	Utilize a case study protocol	Case collection; Case analysis	Yes, fulfilled
	build a case study database	Case collection	Yes, fulfilled

Our case study design is rather biased from the data available as secondary data. We do not make use of primary data that could have been collected through conducting interviews. From this could follow that journalists/marketing departments/HR departments of secondary data may have corrupted (false) or exaggerated the data. To some point we neglected the data because of quality suspiciousness (e.g. social media, forums, etc.). Frequent data conversion could have led to blurred data that could have been misinterpreted. Furthermore, we conducted a single case and have chosen the market leader AWS. A cross-case design with the incorporation of competitors that recently entered the market would be interesting. Furthermore, the generalizability of interpretation is limited. Our coding methodology was rather deductive than inductive. A more exploratory coding method from that new codes emerge could have led to insights outside of our conceptual frameworks.

While conducting our case study analysis the intensity of CPE actor relations as well as DCs was determined subjectively. It barely relied on the researcher's opinion based on objective characteristics. Thus, classifications, e.g. in the field of AWS announcements to strategy response mapping or DC actor intensity could be biased. Furthermore, we neglected to interpret statistical relationships between AWS strategy responses and dynamic capability explications. With our investigation on dynamic capabilities we did not include an operationalized process level, e.g. measuring dynamic capabilities. For simplicity reasons we analyzed the DCs on regard to a high level structure of CPE actors, e.g. cloud recipients instead of a differentiation of private, business and governmental consumers. Thus we neglected the fourth level (level IV Actors) for simplicity reasons.

Further research needs to address the questions of to what extent dynamic capabilities of a competitor that recently entered the market would differ. The same questions could be answered for market followers like Google Cloud or Microsoft Azure. Would interviews with lower level executives like managers and engineers confirm our results? Would an exploratory coding methodology reveal new dynamic capabilities, beyond the conceptual frame of the synthesized frameworks? How would that look like in the case of AWS? Can we gather more insights when we investigate DCs of CPEs in more fine-grained actor distinctions? How can we measure and operationalize dynamic capabilities in an applicable research context (Macher and Mowery (2009); Barreto (2009))? More internal study about various internal operational and strategic measurements that scope the platform ecosystem evolution could be of high interest as well. Tiwana introduces short, medium and long term proxy measures for platform success (Tiwana (2013)). An econometric analysis of the deep relationships between environmental change, dynamic capability explication and strategic response could be helpful to deduce managerial decision paths for successful platform management. For this also the modelling of capabilities could be helpful (Zdravkovic et al. (2013)).

6. Conclusion

This in-depth case study analysis revealed what explicit dynamic capabilities (DCs) Amazon Web Services (AWS) developed as well as their intentions and activities of execution.

We concluded that AWS uses a vast set of dynamic capabilities while sensing business opportunities, seizing their business model and transform this to long-term strategy. In order to gain competitive advantages and financial performance they predominantly manage their entire ecosystem in excessive customer-oriented and innovative ways. Enhancing the customer value by business model readjustments with the help of partner groups leads to long-term, high free cash flows. Openness, modularity and ecosystem- wide knowledge management helps further to gain customer and partner network effects and ultimately leads to exponential growth.

While developing and using dynamic capabilities AWS interacts with a variety of actors, whereas we see the most intense interrelations with customers and partners. Environmental changes in conjunction with a strong sense of dynamic capabilities lead to strategic responses that are mostly of upgrading and realignment nature.

We contributed to the existing literature in that we first synthesized the understanding of dynamic capabilities in cloud platform ecosystems into conceptual frameworks. Secondly, we collected a vast, publicly available case study database and applied DC- and CPE-oriented analysis methods. The interpretation results in a compact conceptual framework with that we contribute to management practice and theoretical research. With these contribution steps we could answer the questions of what, how, why and with whom AWS uses DCs.

Although, we contribute to the literature with our findings, even more insights probably could be gathered by conducting cross-case analyses, applying an inductive coding methodology and using primary interview data. Moreover, future research needs to address the operationalization of dynamic capabilities, econometric relationships as well as cloud platform providers that recently entered the market.

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