EXPLORING VALUE CO-CREATION IN CLOUD ECOSYSTEMS: A REVELATORY CASE STUDY

Complete Research

Huntgeburth, Jan, University of Augsburg, Augsburg, Germany, huntgeburth@is-augsburg.de

Blaschke, Michael, University of Augsburg, Augsburg, Germany, michael-blaschke@t-online.de

Hauff, Sabrina, University of Augsburg, Augsburg, Germany, sabrina.hauff@wiwi.uni-augsburg.de

Abstract

The incentive for IT service and infrastructure providers to participate in cloud ecosystems lies in the generation of rents that cannot be generated individually by either alliance partner – i.e. the opportunity to co-create value. The IS literature on cloud ecosystems is scarce and provides only limited insights on value co-creation in cloud ecosystems. Based on an in-depth case study, we develop a framework which serves as an organizing and simplifying device explaining how value is co-created in different types of cloud ecosystems and what success factors of these different types of cloud ecosystems are.

Keywords: Cloud, Ecosystems, Case Study, Co-Creation, Value.

1 Introduction

> "[Value] co-creation represents one of the most important streams in the IT value research area that will gain greater importance as firms expand collaborative relationships with other firms" (Grover and Kohli, 2012, p. 231).

Interorganisational cooperation in the form of platform ecosystems gains importance in the information technology (IT) industry and especially in cloud computing (Ceccagnoli et al., 2012). Business ecosystems are seen as "decisive factor in competition for tomorrow's distributed world of 'cloud computing'" (Williamson and De Meyer, 2012, p. 32). Amazon Web Services (AWS), Salesforce.com, IBM, Microsoft, Oracle, and SAP are prominent providers of such IT hardware and software platforms. Cloud ecosystems can be defined as orchestrators' extended networks of numerous potentially loosely coupled, officially licensed partners to provide IT services (Markus and Loebbecke, 2013). Large, powerful cloud infrastructure as a service (IaaS) providers act as orchestrators at the core of their ecosystem. The advantage is that the offering of capacities by a cloud ecosystem can exceed what can be provided by any single company. Thus, the incentive for service and infrastructure providers to participate in cloud ecosystems lies in the generation of rents that cannot be generated individually by either alliance partner – i.e. the co-creation of value (Adner and Kapoor, 2010; Iansiti and Levien, 2004; Williamson and De Meyer, 2012).

The information system (IS) literature on cloud ecosystems is scarce and provides only limited insights on value co-creation in cloud ecosystems. Demirkan et al. (2010) examine the performance of a software as a service (SaaS) setup under different bilateral coordination strategies between a SaaS provider and an IaaS provider from the perspective of game theory. Their study can be categorized as analytical, model-driven research which assumes that a single SaaS provider interacts with a single IaaS provider. However, their study focuses rather on a bilateral supply chain than on an ecosystem. Mohammed et al.

(2010) introduce a reference model for a cloud value chain based on an analysis of existing cloud services. Their model includes foundations of Porter's (1985) classical model, value networks, and value grids. By instantiating this reference model, five cloud business models encompassing utility cloud, enterprise cloud, research grids, public cloud, and virtual cloud are presented. Leimeister et al. (2010) concentrate on the identification and definition of actors and roles in cloud ecosystems which they describe as *technology partners* including independent software vendors, SaaS, platform-as-a-service (PaaS), IaaS, developer tools, and management or security services vendors and *consulting partners* encompassing system integrators, strategic consultancies, resellers, agencies, and value added resellers. However, both Leimeister et al. (2010) and Mohammed et al. (2010) do not focus on the particularities of cloud ecosystems, i.e. the opportunity for partners to co-create value for customers. We address this gap in the current literature on cloud ecosystems by examining the following research question in our paper: How is value co-created in cloud ecosystems? By the end, our study presents a framework which serves as an organizing and simplifying device explaining how value is co-created in different types of cloud ecosystems and what are success factors of these different types of cloud ecosystems from a value co-creation perspective.

The remainder of the paper is structured as follows. Section two provides the state of the art on value creation and value co-creation. In section three the case study background and methodology are described in detail. Section four presents the results and interpretation of our empirical study. Section five highlights this study's contributions to research and practice.

2 Theoretical Background

In order to develop a literature-based pre-understanding of value co-creation in cloud ecosystem, we review the extant literature on value creation and value co-creation in B2B partnerships in the following.

Hitt and Brynjolfsson (1996) suggest three perspectives for understanding value creation: theory of production, theories of competitive strategy, and theory of the consumer. The *theory of production* measures value in terms of production costs for a given level of output and "has been used extensively to evaluate the productivity of various firm inputs such as capital, labor, and R&D expenditures" (Hitt and Brynjolfsson, 1996, p. 122). *Theories of competitive strategy* measure value in terms of business profitability gained by intelligent business strategy and barriers for competitors to enter a market. The focus is shifted away from productivity on the question of whether "firms will gain competitive advantage and therefore higher profits or stock values" (Hitt and Brynjolfsson, 1996, p. 123). Finally, *consumer theory* measures value in terms of how much total benefit is conferred to a purchasing consumer by computing the total consumer benefit based on revealed spending patterns.

Whereas the literature on value creation by one *single* organization has seen much elaboration and follow-up research for over 70 years (e.g., Porter, 1985), value in the context of B2B partnerships such as ecosystems remains rather uncovered. The nature of co-created value lies in the generation of rents that cannot be generated individually by either alliance partner. We follow the definition of co-created value "[…] as a common benefit that accrues to alliance partners through combination, exchange, and co-development of idiosyncratic resources […]" (Lavie, 2006, p. 645). Even though the term resource is explained initially only below (cf. resource-based view), we perceive the definition instrumental at this point as it highlights that value co-creation can be measured in terms of relation-specific assets, knowledge-sharing routines, complementary resources, and effective governance mechanisms (Lavie, 2006). This is in line with the notion by Madhok and Tallmann (1998, p. 328) that value needs to be assessed "in terms of the ability of the partners to earn rents over and above what could have been achieved in the absence of the partnership". In contrast, some researchers (e.g., Das and Teng, 2000) draw on measuring co-created value by "focusing on the profitability derived from meeting goals or on the longevity of the alliance" (Sarker et al., 2012, p. 319).

The primary theory base of value co-creation is the resource-based view (RBV) of the firm (e.g., Das and Teng, 2000; Lavie, 2006; Wade and Hulland, 2004), which combines the rationale of economics with a management perspective. Dating back to Penrose (1959), the RBV has become an influential framework in the strategic management literature (Wade and Hulland, 2004). For instance, resources can be described "[…] as stocks of available factors that are owned or controlled by the firm" (Amit and Schoemaker, 1993, p. 35). The RBV argues that firms can achieve a competitive advantage based on valuable, rare and appropriable resources. If those resources are hard to imitate, substitute and move, then firms can benefit from a sustainable competitive advantage (Barney, 1991). Using RBV as theoretical lens, studies have found significant differences regarding firm performance that arise from individual, firm-specific resources between firms in the same industry (Wade and Hulland, 2004; Lavie, 2006). In this paper, we define resources as "assets and capabilities that are available and useful in detecting and responding to market opportunities or threats" (Wade and Hulland, 2004, p. 109).

Although the resources each organization contributes to a B2B partnership are the essence of the relationship, the more important question is how these resources are *aligned* together as this determines the success of value *co*-creation (Sarker et al., 2012). Two forms of alignment are known, namely a complementary and a supplementary resource alignment (e.g., Das and Teng, 2000; Lavie, 2006; Sarker et al., 2012).

First, in the case of *supplementary resource alignment*, firms provide and pool similar kinds of resources that both the hub firm and its partners own. When firms share such a substantial amount of resource sets, this intersection is referred to as a pooling, supplementary, homogeneous, or horizontal ecosystem in literature (e.g., Lavie, 2006; Han et al., 2012). The partners' advantages are greater scale, enhanced competitive position, economic efficiency, and strategic, organizational, and operational compatibility in their industry, as integrated supplementary resources "[…] create more value […] than the sum of the separate values of the resources with individual firms" (Das and Teng, 2000, p. 49). Resource pooling improves the economic efficiency by reaching an enhanced market position and mitigating the problem of vendor lock-in (Satzger et al., 2013).

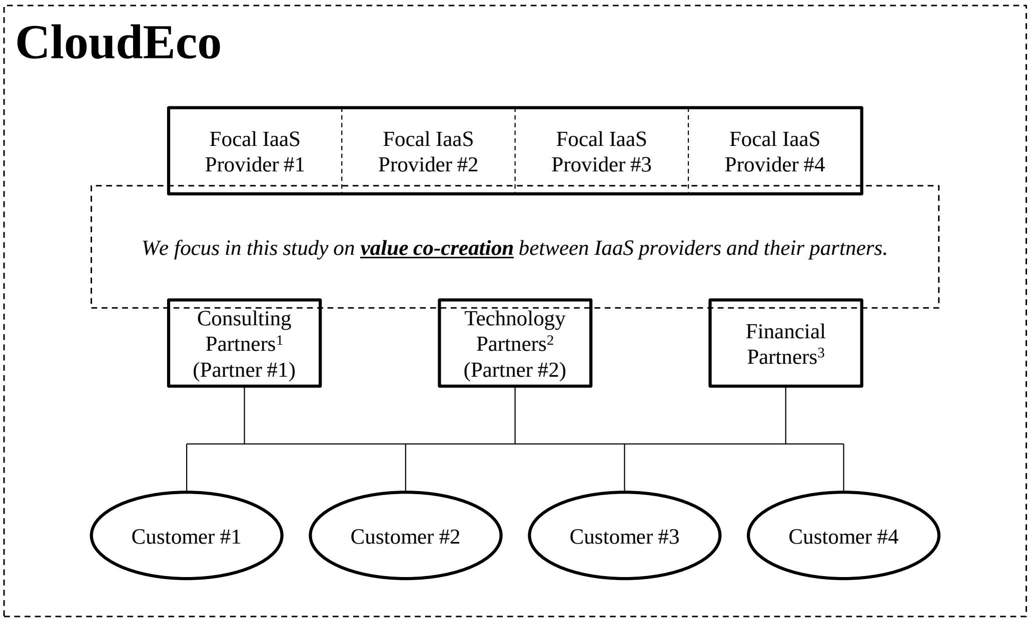
Second, there is *complementary resource alignment*, which is the opposite of supplementary resource pooling. In this case, firms only have a diminutive resource intersection. The primary focus of such a partnership is not economic efficiency (Han et al., 2012), but "firms seek to achieve synergies by employing distinct resources that are difficult to accumulate in combination by any given firm" (Lavie, 2006, p. 644). Firms participate in such vertical ecosystems to get access to resources that are otherwise hard to obtain (Hill and Hellriegel, 1994). Companies with a strong technological team can for example benefit from a cooperation with another firm that has sophisticated marketing skills and sales channels. These additional resources can help such technology partners to more easily enter the market with its technological product (Sarker et al., 2012). In such a resource multiplicity view, the notable goal is to create new, innovative products and services, which is why "heterogeneous partners can widen a window of opportunities in the form of new product and market expansions, which are not easily facilitated in the case of the horizontal integration with homogeneous participants" (Han et al., 2012, p. 296). Thus, complementary resource alignment can result in larger benefits because resource multiplicity can outweigh the benefits generated from economic efficiency (e.g., Grover and Kohli, 2012; Jacobides, 2005; Lavie, 2006).

Literature on value co-creation in IS is rare and does not go beyond collaboration in e-commerce (e.g., Sutton, 2008). One exception is the work of Sarker et al. (2012) who provide another perspective on the alignment of resources by exploring three modes of value co-creation: exchange (resource bartering), addition (resource layering), and synergistic integration (resource amalgamation). *Exchange* is defined as "as a nominal form of cocreation, where the two participants in an alliance develop value by each providing resources/competencies that the other partner needs to effectively serve the clients" (Sarker et al., 2012, p. 325). *Addition* "is evident in the way in which one of the two parties (i.e., […] partners, especially those involved in sales, implementation, and customization) build on contributions of the other in order to develop revenue streams for both" (Sarker et al., 2012, p. 326). Learning-based value is typically missing as it is of short-term advantage and cannot be easily transfered outside the alliance transaction. In *synergistic integration* "both sides have to (1) work together with each other, in a mutually reinforcing manner, (2) surrender some of their own autonomy, (3) have trust in the other to do what is in the interest of both sides of the relationship, and (4) invest in the relationship rather than just look for gains out of it" (Sarker et al., 2012, p. 327). Significantly higher levels of value are co-created as this multifaceted and long-term co-creation enables collaboration specific rent earning capacity. In the following, we apply these three modes as foundation to understand how value is co-created in cloud ecosystems.

3 Research Design

3.1 Case Background

The phenomenon of cloud ecosystems is examined in a unique context – that of four leading European public cloud IaaS providers delivering solutions to client organizations in cooperation with partners over a shared platform. The four leading European public cloud IaaS providers act as one integrated orchestrator to offer storage and processing capacities with a scale and complexity exceeding what can be provided by any single company. Moreover, they orchestrate numerous partners with technology, consulting, and brokerage roles as well as data resources (cf. Figure 1). CloudEco was founded during a two year pilot phase in 2012 and 2013. It has been founded to meet the needs of European IT-intense scientific research organizations to support their massive IT requirements.



1 System Integrators, Consultancies, Resellers, Agencies, and VARs
2 Cloud Brokerage, ISVs, SaaS, PaaS, Product Companies & Developer Tools, and Management/Security Vendors
3 Governments, Payment Services, Investors, and Financial Services

Figure 1. The Relationship between Infrastructure Providers, their Partners, and Customers

3.2 Methodology

CloudEco is a revelatory, unique, and exemplary source of insight on our topic (Hauff et al., 2014). With four federated IaaS providers orchestrating partners with technology, consulting, and brokerage roles, it ideal-typically matches the ecosystem definition. CloudEco brings together leading IT companies and Europe's leading research centres to foster the enforcement of cloud computing as an IT outsourcing mechanism (Schneider and Sunyaev, 2014). Its partner program focuses on helping officially licensed consulting, technology, and financial partners to build a successful platform-based business by providing them with technical, business, and marketing support. The ecology of the CloudEco project team and its partners represents a unique context where the topic of cloud ecosystems can be investigated in depth. The goal of our case study is to generalize our empirical insights from the case to a theory on the phenomenon under investigation based on analytical generalization (Yin, 2009).

Our engagement with CloudEco enabled an intensive data collection on co-creation through semi-structured interviews and other documentary evidence. It contributed to our broader understanding of CloudEco's business environment. One of the authors was accompanying the project scientifically from April 2013 to February 2014 and collected data in strategy workshops and weekly meetings with all partners. Further, he had access to feasibility studies that were produced during the pilot phase. Specifically, ten interviews were conducted in November and December 2013. The semi-structured interviews were carried out with representatives from the customer organizations, focal public cloud IaaS providers, partner firms, and external firms (cf. Figure 1 and Table 1). Initially we introduced the case's structure (cf. Figure 1), the research question, and the preliminary value co-creation modes. Then we followed a guideline to discuss each of the generic model's three modes (exchange, addition, integration) for approximately twenty minutes, whereby the discussion on each dimension was triggered by an open question. External experts were included to capture the outsider's view of potential partners. Based on the methodological guideline of Sarker and Sarker (2009), we chose suitable interviewees who were suggested to us by senior managers. We made sure that all experts had cloud and ecosystem knowledge. On average, an interview lasted one hour.

Organization	Brief Description	Interviewee Position/Role
Customer #1	European intergovernmental big science (2,250 employees) Research in space and earth surface exploration	Satellite Mission Manager (C1_M)
Customer #2	European intergovernmental big science (1,900 employees) Research in life science	Head of IT Services (C2_M)
Focal #1	Multinational IT services corporation (78,000 employees) Solid track record in developing and delivering cloud services Leads the cloud platform and provisioning in CloudEco	Principal Solutions Architect (F1_M)
Focal #2	Pure public IaaS provider (40 employees) Enterprise-class cloud servers and cloud hosting solutions Leads the user and service requirements in CloudEco	Manager Enterprise Solutions Architecture (F2_M)
Partner #1	Multinational IT services corporation (69,000 employees) IT infrastructure and managed services experience Leads the flagship deployment as technology partner for IT infrastructure brokerage in CloudEco	Solutions Architect (P1_M)
Partner #2	Cloud and distributed system solution provider (20 employees) Specialized in agile delivery and process automation Leads the technical architecture track in CloudEco	Co-Founder (P2_M)
External #1	Multinational software and IT services corporation Cloud-based applications with the largest web-based trading ecosystem 2,600 employees	Vice President of Business Network Strategy (E1_M)
External #2	Multinational enterprise software corporation Industry's only in-memory cloud platform ecosystem 65,000 employees	Senior Director of Global Business Development (E2_M)
External #3	Multinational management consulting, technology services and outsourcing professional service provider Worldwide leading consulting experience in cloud service integration 275,500 employees	Cloud Ecosystem Alliance Channel Director (E3_M#1) Lead Architect of Agile IT (E3_M#2)

Table 1. Organizations and Profiles of the Interviewees

Overall, our approach can be characterized as interpretive in the sense that it takes the interview partners' experiences with cloud ecosystems to develop a "second-order theoretical understanding" of value co-creation in cloud ecosystems (Lee, 1991; Sarker et al., 2012). Overall, the methodological guidelines summarized by Sarker and Sarker (2009) were utilized for the data analysis and representation. Coding as a tool in qualitative research was applied to support data complexity reduction. We relied on a priori codes based on the three modes of value co-creation revealed by Sarker et al. (2012). The step of coding was performed with the help of the specialized computer program ATLAS.ti 7. The constant comparative process involved data triangulation. Whenever possible, we compared responses across interviewees, types of organizations, and organizational roles of respondents (Patton, 2002). We do not consider the lack of agreement as problematic, but as an opportunity to include/explore differing perspectives and unearth additional contingencies (Flick, 2009). Once a disagreement appeared, it served as starting point to investigate more in-depth on the respective topic in the remaining interviews. As a consequence, a richer and contingent understanding emerged (Sarker and Sarker, 2009).

4 Interpretation and Results

The analysis and interpretation of our data revealed two major findings. First, we identified instantiations of the three modes of value co-creation (exchange, addition, and synergistic integration) in the context of cloud ecosystems in our data. The cloud-specific mechanisms of these modes were explored in detail. Moreover, we unveiled different success factors for these distinct modes of value co-creation: The trivial mode of *cloud ecosystem exchange* depends on formal and informal ecosystem governance mechanisms and flexibility in terms of contractual and technological design. The mode of *cloud ecosystem addition* requires deliberate orchestration by either one single market incumbent or an alliance of those. Cloud ecosystem integration – value co-creation in its narrowest sense – requires successful handling of process and data access complexity as well as an incentivizing model for partners and customers that leverages direct and indirect network effects. Our interpretations allow us to develop a theory that systemizes cloud ecosystems by pointing out similarities and differences between them. In the following, we present our contextual understanding of value co-creation in cloud ecosystems. For each mode, we present a definition, empirical evidence, success factors, and the co-created value for the customer.

4.1 Cloud Ecosystem Exchange

Definition. *Cloud Ecosystem Exchange* is a nominal mode of cloud-related value co-creation, where (1) at least two, but mostly multiple public cloud infrastructure providers federate, barter and pool IT infrastructure (i.e., networking, storage, servers, visualization, processing) on an integrated, standardized cloud platform to (2) co-create value by enhancing scalability, reducing cloud vendor lock-in and providing feedback and expertise that other providers and partners need to effectively serve customers.

Examples. To mention example software/services being operated in the this form of collaboration, the four IaaS providers offer to each other IT infrastructure resources for hourly compensation on an internal CloudEco storage and capacity market to reach a better scale and elasticity of the platform. Further, they exchange feedback both on potential/planned technological changes and expertise on new products/services of CloudEco.

Empirical Evidence. *First*, we see evidence of exchange in the *federation* of the four public cloud IaaS platform providers (e.g., Focal #1, Focal #2) who barter and exchange IT infrastructure resources (storage, processing, and network) to improve their value proposition for European leading intergovernmental science organizations who consume IT infrastructure (e.g., Customer #1, Customer #2). During the interviews, this concept of IT resource pooling was constantly mentioned as providers in the common industry of cloud computing can serve the market of IT outsourcing for intergovernmental big science, which is an enormous uncapped market. The research organizations have only outsourced their IT homoeopathically. The scale and complexity of the CloudEco platform reaches far beyond what a single company can provide on its own as derived from the following evidence.

> *"The requirements of the existing demand side [European intergovernmental big science] could not be handled solely by one of the providers […]. By working together, we are able to build towards a scale which […] no single cloud provider can offer. […] We are able to offer large amounts of cloud computing resources." (P1_M)*

Second, consulting, technology, and platform partners (i.e., four public cloud IaaS providers) *confer with each other* on potential and planned changes by each CloudEco participant to avoid wrong functionality that is inconsistent with the standards of the CloudEco platform. Thereby reducing vendor lock-in, the collaborating platform providers' benefits are greater scale, enhanced competitive position, economic efficiency, and strategic, organizational, and operational compatibility in their industry by mitigating the foremost problem of cloud vendor lock-in. We derive this interpretation from the following empirical evidence.

> *"By working in collaboration with our co-suppliers, we have more chance of [customers] actually taking cloud services to do this than if we went along as one single [infrastructure] supplier […]. […] They can switch between them and […] it gives them the comfort feeling that they are not locked into a particular vendor." (F1_M)*

Third, all partners develop *expertise* on new products/services of CloudEco (e.g., hybrid cloud deployment models, new storage or processing technologies) even before its release to benefit from a competitive advantage. Once the product is officially available for the customers, partners co-create value for the clients by faster implementing new products. Especially those partners involved in sales, implementation, and customization depend on the exchange of platform expertise and support as the effective platform use by partners is the key driver for the infrastructure providers. The co-created value is that third parties add new software or services effectively without implementation issues. Without this exchange of expertise, customers might think that CloudEco is not the right solution, which most likely it is. Therefore, CloudEco ensures that the partners are highly educated, skilled, and trained to use that platform. Best practices include technical support with recurring product roadmap briefings, technical training and content, technical support credits, and exclusive training webinars. CloudEco partners and external experts confirmed this exchange of expertise:

> *"Every cloud is different. So we [as consulting company] look at each provider as a solution alternative and then we need to map that to what the customer's needs are. […] The [infrastructure] providers need to know that the consultants have full understanding of their solution capabilities and have the knowledge to use it effectively. […] If External #3 isn't using CloudEco effectively, it could make the customer think that CloudEco isn't the right solution." (E2_M)*

Success Factors. First, "[…] the number one top enabler […]" (F2_M) for cloud ecosystem exchange is *governance* as our literature review on B2B platform ecosystems and the findings of our data analysis show. This factor has been most often mentioned and the interview partners also gave very enthusiastic statements about how it leads to success. Governance is of utmost importance especially for cloud ecosystem exchange, as direct competitors in the common industry of public cloud IaaS (i.e., the four orchestrators) pool their similar IT-infrastructure resources. Thereby, they built a strategic alliance in which a small number of firms that usually compete with each other in similar or equal roles (e.g., train operators or automakers) work together contractually. Aim of this so called coopetition, a neologism and portmanteau of cooperation and competition (Ritala, 2012), is to supplement offerings and pool resources, broaden coverage, and/or lower costs (Mohammad Masrurul, 2012). Coopetition in the exchange mode requires an effective governance that defines a control structure with "[…] enforcement mechanisms that can counter the threat of opportunism inherent in an alliance and safeguard partners' interests […] [by focusing] on the maintenance of order within the relationships" (Sarker et al., 2012, p. 320). Two categories of instruments can prevent the leakage and opportunistic exploitation of proprietary knowledge. An ideal foundation of cooperation would be self-reinforcing and informal mechanisms such as trust, goodwill, and commitment (Sarker et al., 2012). However, in reality often more formal and wary isolation mechanisms have to be put in place such as patents, trademarks, or contracts to protect strategic resources (Lavie, 2006). In addition, installing effective governance mechanisms helps to reach a fair and traceable distribution of revenue streams amongst all involved participants.

> *"It has been very instrumental […] to have […] a lightweight governance already from the beginning […] where we have formal procedures how […] new technologies were brought on*

board, how different players were asked to play together, and what the rules and policies were that they need to stick to." (C2_M)

"The number one top enabler is that we have CloudEco [as governance framework]. […] Having a framework, a governance model, is a great enabler. We now have committees that decide: 'No, no, you cannot beat each other up. You have to play by the rules.' And we have guidance. […] CloudEco itself is the enabler." (F2_M)

Second, another cloud ecosystem exchange success factor revealed from our data is to establish contractual and technological *flexibility*. Flexibility "[…] describes the ability to respond quickly to changing capacity requirements and competition pressure" (Repschlaeger et al., 2012, p. 6). The knowledge base differentiates many factors influencing flexibility. They can be condensed in the categories contractual and functional/technical flexibility (e.g., Armbrust et al., 2010; Benlian et al., 2011; Repschlaeger et al., 2012). Contractual flexibility covers the degrees of freedom customers have to change payment models and cancellation periods. Functional/technical flexibility covers scalability, interoperability, and modularity (Benlian et al., 2011). Empirical evidence for flexibility as a success factor for cloud ecosystems follows:

"The other aspects are […] technology bound. [Cloud ecosystem exchange] will certainly offer much more flexibility than one individual organization can leverage and handle. Flexibility is key. It will be key to have elasticity of individual infrastructures. It will be much bigger than the ones […] provided by individual resources." (C2_M)

"The technology advantage and nature is that the underlying technology for cloud application can be changed much faster and helps all the companies using it at one time. It is much more efficient and effective because it is not buried inside of each individual company." (E1_M)

Co-created Value. As a result, the co-created value generated in a cloud ecosystem exchange is higher scale and elasticity of the platform as peak demands by one IT infrastructure provider can be mitigated due to the explained hourly compensated exchange on an internal CloudEco storage and capacity market to reach a better scale and elasticity of the platform. Further, interorganizational, technological standards reduce cloud vendor lock-in.

4.2 Cloud Ecosystem Addition

Definition. *Cloud Ecosystem Addition* is a loosely coupled mode of cloud-related value co-creation, where (1) one of the multiple, officially licensed cloud ecosystem IT infrastructure or partner parties add a further layer of cloud skills, resources, and experiences on contributions of the underlying cloud layer to (2) develop revenue streams for the cloud ecosystem one party alone could not generate.

Examples. To mention example software/services being operated in this form of collaboration, the technology and consulting partners offer an all-in-one marketplace including hybrid and multi-cloud deployment. They layer their services on the IaaS providers' infrastructure to eventually offer together a marketplace to users (i.e., B2C, B2A, B2B). Further, a cloud brokerage service is offered to interconnect the marketplace offerings by technology/consulting partners.

Empirical Evidence. First, we recognise this mode of value co-creation as technology partners (e.g., PaaS, SaaS, or brokerage) and consulting partners (e.g., integration or managed hosting), competing in the common industry of cloud computing, layer additional skills, resources, and experiences on the IaaS platform in a catalogue of services respectively marketplace. Therefore, the partners add a layer of contribution to the infrastructure platform to develop value for both sides. The focal IaaS firms described the marketplace as central vehicle for market presence and exploitation. Former research recommends the hub firms to contribute an "assets layer" which is defined as "a component or activity on which the overall value of the ecosystem to the customer depends and which is difficult to replace with a substitute offering" (Grover and Kohli, 2012, p. 226). The marketplace appears to be a suitable assets layer for hub firms to capture "[…] license fees, royalties, expanded margins, or profits on higher sales volumes" (Williamson and De Meyer, 2012, p. 43).

> *"There are some practical things we [as IaaS providers] need […] like a catalogue of services. You have to be able to go and find what is it you might want to use and it has to be comparable enough. […] So it has to be a catalogue that in some degree allows comparison […] as a full catalogue that does not provide comparison is probably an inhibitor […]." (F1_M)*

> *"What we end up with is in essence a marketplace where cloud vendors – again a small chosen group to begin with, but eventually a larger group of cloud vendors – will be able to come and offer their […] services in a way that will be understandable to the potential user community and will be governed by a set of service and business and technology rules." (F2_M)*

Second, the global reach and signal effects are contributed or added by the IaaS providers. Through marketing ecosystems, signal effects can be created for both market incumbents, who establish the ecosystem, and for partners (e.g., Ceccagnoli et al., 2012; Han et al., 2012; Lavie, 2006). The more partners a hub firm can gather in its partner program, the more it signals a rich service portfolio, de facto standards, high market coverage and importance. A participant's visibility, reputation, image, and prestige is likely to be increased by the reputation of a large partnering incumbent as also seen in the data:

> *"Focal #1 is a public cloud provider that tries to differentiate itself within the competitive market place as being a leader, a thought leader and an execution leader in this environment of big science, this ecosystem of big science. So for us the opportunity is to present to a community of scientists our ability to do work for them." (F2_M)*

> *"It is a beacon to the world that something very exciting is going on here, and, by the way, that red square [which is Partner #2's logo] in the logo panel [of CloudEco] is us and we are on it. That puts us on the map and that is immensely valuable." (P2_M)*

Success Factors. First, forming and dissolving multiple types of relationships is a mayor success factor of cloud ecosystem addition. Dhanaraj and Parkhe (2006, p. 659) define ecosystem orchestration "[…] as the set of deliberate, purposeful actions undertaken by the hub firm as it seeks to create value (expand the pie) and extract value (gain a larger slice of the pie) from the network." Hub firms need the competency of good orchestration because they need to balance the tension between simultaneous cooperation and competition across different types of resources over time (Venkatraman and Chi-Hyon Lee, 2004).

> *"[…] it is not only technical orchestration which is challenging due to different technical implementations of the cloud resources, but it is also contractually and process-wise an orchestration challenge. […] That is another level of complexity or challenge in terms of orchestrating all these things together." (C2_M)*

> *"The onboarding process needs to be very fluid. The quality of the different components […] from information we put up to the blue box [as brokerage technology] to the cloud providers needs to be of the greatest quality […] and we need to orchestrate it all so that the user experience is amazing." (P2_M)*

Second, our data strongly indicates that cloud ecosystem addition depends on the success factor *strategic enablement*, a key service desire in cloud computing defined as "the extent to which cloud can enable creativity and innovation by lowering the transaction costs associated with innovation and enabling the development of value-networks" (Venters and Whitley, 2012, p. 190). CloudEco needs to have a compelling first product and a compelling vision of why a customer or partner should join CloudEco, because the commitment to put applications in this kind of environment is a very significant commitment.

> *"Switching platforms is very difficult. So the barrier to enter the decision process for someone to commit to a brand new platform will be very difficult unless we can create that extra value, extra vision and make the first product extremely valuable to [customers and partners]. So why would we get somebody else, especially if we are less than someone else." (E1_M)*

> *"But all of these things are new things, new services, new ideas, and new economy. It is not going to help the current SAP ERP deploying models or adoptions. […] It is going to play a significant role there. […] It is inventing new things and not transferring current things." (P2_M)*

Co-created Value. To conclude, the co-created value generated in cloud ecosystem addition is a cloud computing marketplace which offers hybrid and multi-cloud deployment scenarios appropriate to existing business processes and in-house IT. Through layering, a European cloud computing marketplace provides customers with a larger service pool including especially hybrid and multi-cloud deployment scenarios. They see their federated, pooled infrastructure platform as a layer on which further additional services can be contributed in a marketplace. Cloud integration is enabled by generic cloud brokerage services by technology and consulting partners hosted on the platform. Yet, co-creation with such a high number of firms in a *loosely coupled* cooperative arrangement causes a constant fluctuation of technology and consulting partners (Dhanaraj and Parkhe, 2006). In a fundamental contribution, loose coupling is defined as "[…] a situation in which coupled elements are responsive, but retain evidence of separateness and identity" (Weick, 1976, p. 3). Therefore, we also see this mode as short-lived and not transferable outside the alliance transaction.

4.3 Cloud Ecosystem Integration

Definition. *Cloud Ecosystem Integration* is a multifaceted and long term mode of cloud-related value co-creation, where multiple complementary cloud parties (1) amalgamate IT infrastructure, data, and software resources in a mutually reinforcing manner, (2) surrender some rights concerning data intellectual property (IP) and IT infrastructure access, (3) have trust in third parties' IT infrastructure, data, and/or software usage, and (4) invest in the cloud ecosystem rather than just looking for short-term gains. As opposed to the nominal form of cloud ecosystem exchange and short-lived and non-transferable form of cloud ecosystem addition, we perceive this form of value co-creation – synergistic cloud ecosystem integration – to be value co-creation in its narrowest sense.

Examples. To mention example software/services being operated in this form of collaboration, the IaaS providers cross-fertilize and exploit data hosted by the European intergovernmental big science as data providers (e.g., Customer #1, Customer #2) with the help of the technology partners for data analysis. In this three-role setting, infrastructure, data, and software resources are amalgamated ("diminutive resource intersection", Lavie, 2006) to provide integrated, customized new information services. Partner #1 and partner #2 customize their data analysis software to offer a service for the detection, mapping, monitoring and forecasting of ground deformations, including landslides and ground subsidence.

Empirical Evidence. First, to reach this level of co-creation, the collaboration needs to generate new products or services with substantially more value potential than what each alliance partner can generate separately with its own resources. We find empirical evidence for this mode of co-creation in the following data service of CloudEco. The IaaS providers cross-fertilize and exploit the data hosted by the European intergovernmental big science as data providers (e.g., Customer #1, Customer #2) with the help of the technology partners for data analysis. From an *academic* perspective, we now understand how the alliance partners bring in both complementary (infrastructure, data, and analysis software) and supplementary resources (data sets by various cloud customers) and harness them in unison to establish a fundamentally new form of cloud ecosystem business.

> *"The fact that soon the data is going to be there will actually trigger and create basically a huge new generation of businesses, especially when we can actually start cross-fertilizing the data […] then that becomes a very, very powerful tool to actually create new things." (P2_M)*

> *"It is complementation and aggregation of data and information from public, quite unrelated resources and [CloudEco] pools and puts that together and arrives at new opportunities and new insights. […] That is one. If we focus on the future and why we would see information as a service being important, then that was one driver. The other driver was partly also kind of an outsourcing argument that we could use external capacities in order to facilitate providing IT sources in times of peaks or in times of very fast deployment […]." (C2_M)*

Second, Customer #1 surrenders some of its own *autonomy* (i.e., IP rights on the data) as its crude data is stored on Focal #1's IT infrastructure. Customer #1 already offers restrained datasets free of charge and made the long-term commitment to offer its data to an even greater public. Empirical evidence for the customers' motivation to make their data fully accessible was given by C1_M:

> *"So the only value [the data] has right now is the archive, […] and so I want to get my mission, the old mission – 20 years of data, highly calibrated, validated, really excellent data sets – […] exploited […] in a cross-domain context. […] So we have covered the full spectrum of the earth and we have to get it now in semantic areas like societal benefit areas, flooding and health, disasters. So that's what I try to get my mission in. For that, I think, the cloud is unique because it puts our data, enables our data to be put in new context with open source tools to get the knowledge of other communities, working our data and further exploit the missions to show that all the data has an enormous boost and value […]." (C1_M)*

Success Factors. First, successful handling of process and data access complexity is a critical success factor as especially in the mode of synergistic cloud ecosystem integration a growing network of hundreds or even thousands of data providers bring in data from diverse areas in various formats. The complexity in cloud ecosystem integration is caused by data governance issues and the heterogeneous data access patterns, which are a "[…] real, gigantic, massive challenge of this model [of cloud ecosystem integration]" (F2_M). The problem is to reach a point where data from completely different resources can be aggregated. Objectively, this is technically feasible, yet it involves costs and time to elaborate the access patterns as basic principles to be able to aggregate data. It is insufficient to put data from different sources into one or many individual data marts and then assume that intellectual property or future knowledge or insight comes by itself just by connecting to different clouds.

> *"Data is going to be the issue. Are we going to have a sort of a semantic way of harmonizing it all? Are we going to agree on access patterns to compare or mesh this data together or is it going to remain bespoke where different intermediaries […] specialize in services that can easily consume the data." (P2_M)*
>
> *"It is very, very challenging to take data in different formats and try to make it seamlessly available. That is a real, gigantic, massive challenge of the information as a service model as data today exists in many different repositories, many different formats, and many different access protocols." (F2_M)*

Second, the interviewees revealed that especially synergistic cloud ecosystem integration requires a sophisticated *incentivizing model* for partners and customers that leverages direct and indirect network effects to boost platform adoption (Shapiro and Varian, 2013). During the interviews and our prolonged period of engagement with CloudEco, it has emerged that gaining partners and customers in cloud ecosystem integration is much more difficult than in the other two modes. Therefore, incentivizing has emerged to have an increased importance in cloud ecosystem integration. CloudEco partners and external experts confirmed that aspect:

> *"We need to be a lot more dynamic in welcoming players. […] The [hub] cloud providers need […] to help those new partners to come in opposed to be competitors and the data providers like the big Customer #1 and Customer #2 […] making their data easier to consume." (P2_M)*
>
> *"Trust is very important in this area and […] the business model […]. […] It has to be ensured that Customer #1 gets money, but also the [other] data providers as well. For example, if somebody is buying the [information] service from Customer #1 in this case, all of the data providers should have also a revenue stream on top." (E2_M)*

Co-created Value. Cloud ecosystem integration results in co-created, integrated, and customized new information and data services. Thereby, customers are enabled to manage the risks posed by ground deformations. Furthermore, the synergistic integration of cloud firms yield in cross-fertilization and analysis of big data in heterogeneous formats.

4.4 Discussion

This section provides a comparison of the three modes. We propose that *innovative* cloud ecosystems are only the result of synergistic integration. Cloud ecosystems can only exploit their full potential on an ongoing basis of the co-created value if they manage the challenges of this mode (i.e., reinforcing cooperation, loss of autonomy, trust and common interests, and relational investments). We highlight the limitation of gathering data for each distinctly different role from two to three people which is not sufficient to reach credibility beyond the inherent logic of the points presented.

All three modes yield in co-created value for the customer (cf. Table 2). First, bartering and pooling of IT infrastructure resources (i.e., networking, storage, servers, visualization, processing) by European public cloud IaaS providers co-creates the value of higher scale and elasticity of the platform and reduced cloud vendor lock-in due to the choice between four IT infrastructure providers (*cloud exchange*). Second, the layering of consulting and technology services on a marketplace (partners) and ability to provide global reach and signal effects (platform providers) co-creates the value of the existence of a European-wide integrated, trusted cloud computing marketplace for hybrid deployment models and generically available services by technology and consulting partners hosted on the platform (*cloud addition*). Third, the amalgamation of IT infrastructure, data, and software resources (i.e., diminutive resource intersection) co-creates the value of integrated, customized new information services (*cloud integration*). Cloud ecosystem exchange and addition are rather simple, single-sided, and straight forward commodity markets characterized by aggressive pricing, currently resulting in a prize competition (Waters, 2013). Those two modes have a track record in the ICT industry and are well-known by most cloud computing market participants (Leong et al., 2014). In contrast, the integration mode is a complex, multi-sided, and ambiguous mode with no track record on this scale. This inexperience was adequately compared by F2_M with the story of the *Blind Men and an Elephant*: “Because each person’s view is limited to his local region, it is not surprising that the blind men will each conclude independently that the elephant ‘feels’ like a rope, a hose, or a wall, depending on the region each of them is limited to” (Wu et al., 2014, p. 3). A summary of our theory that systemizes cloud ecosystems by pointing out similarities and differences between them is provided in Table 2. The success factors are cumulative, so that those of cloud exchange apply to cloud addition and integration as well.

	Cloud Ecosystem Exchange	Cloud Ecosystem Addition	Cloud Ecosystem Integration
Definition	*Cloud Ecosystem Exchange* is a nominal mode of cloud-related value co-creation, where (1) at least two, but mostly multiple public cloud infrastructure providers federate, barter and pool IT infrastructure (i.e., networking, storage, servers, visualization, processing) on an integrated, standardized cloud platform to (2) develop value by enhancing scalability, reducing cloud vendor lock-in and providing feedback and expertise that other providers and partners need to effectively customers.	*Cloud Ecosystem Addition* is a loosely coupled mode of cloud-related value co-creation, where (1) one of the multiple, officially licensed cloud ecosystem IT infrastructure or partner parties add a further layer of cloud skills, resources, and experiences on contributions of the underlying cloud layer to (2) develop revenue streams for the cloud ecosystem one party alone could not generate.	*Cloud Ecosystem Integration* is a multifaceted and long term mode of cloud-related value co-creation, where (1) multiple complementary cloud parties amalgamate IT infrastructure, data, and software resources in a mutually reinforcing manner, (2) surrender some rights concerning data IP and IT infrastructure access, (3) have trust in third parties' IT infrastructure, data, and/or software usage, and (4) invest in the cloud ecosystem rather than just looking for short-term gains.
Examples	① Exchanging storage and capacity on an internal CloudEco market based on hourly compensation ② Exchanging feedback on potential/ planned technological changes ③ Exchange of expertise on new products/services of CloudEco	① Adding a layer of partner services on the infrastructure platform to develop a marketplace ② Adding global reach and signal effects by the platform providers to their partners' services	① Integration of infrastructure, data, and software resources to cross-fertilization data sets ② Surrendering some autonomy in form of IP rights on the data
Success Factors	① Formal and informal ecosystem governance mechanisms to resolve coopetition-tradeoff ② Contractual and technological flexibility	① Deliberate orchestration ② Enabling customers' creativity and innovation capabilities	① Successful handling of process and data access complexity ② Incentivizing model for partners and customers that leverages direct and indirect network effects
Co-created Value	① Higher scale and elasticity of the IT infrastructure platform ② Reduced cloud vendor lock-in due to expertise and feedback exchanges	① All-in-one marketplace including hybrid and multi-cloud deployment ② Generic cloud brokerage services by technology/consulting partners	① Integrated, customized new information and data services ② Cross-fertilization and analysis of big data in heterogeneous formats

Table 2. A Classification Scheme of Cloud Ecosystems

5 Summary and Outlook

To address the research question how value is co-created in cloud ecosystems, we identified instantiations of three modes of value co-creation (exchange, addition, and synergistic integration) (Sarker et al., 2012) in our data. Cloud ecosystem exchange co-creates higher scale and elasticity of the IT infrastructure platform and reduces cloud vendor lock-in due to expertise and feedback exchanges. Cloud ecosystem addition co-creates value by establishing an all-in-one marketplace including hybrid and multi-cloud deployment models and generic cloud brokerage services offered by technology and consulting partners. Cloud ecosystem integration – value co-creation in its narrowest sense – co-creates integrated, customized new information and data services by using the data hosted on the infrastructure platform. Furthermore, through cloud integration big data in heterogeneous formats is cross-fertilized and analysed. The presented framework serves as an organizing and simplifying device that helps to understand how value is co-created in cloud ecosystems. By the end, our theory contributes to cloud ecosystem comparison by pointing out similarities and differences between them with respect to success factors and outcomes.

We believe the study provides a fertile ground for future research. A first potential step might be the quantitative evaluation and refinement of the presented framework's modes and success factors. CloudEco itself appears to be suited for such an objective as it has only been implemented. This may help to gain broad range experience regarding long-term usage of the framework. Second, further case study research might help to overcome the limitations of the missing prioritization, evaluation and completion of the frameworks' success factors.

References

Adner, R., and R. Kapoor (2010). “Value Creation in Innovation Ecosystems: How the Structure of Technological Interdependence Affects Firm Performance in New Technology Generations.” *Strategic Management Journal* 31 (3), 306–333.

Amit, R., and P. J. H. Schoemaker (1993). “Strategic Assets and Organizational Rent.” *Strategic Management Journal* 14 (1), 33–46.

Armbrust, M., A. Fox, R. Griffith, A. D. Joseph, R. Katz, A. Konwinski, G. Lee, D. Patterson, A. Rabkin, I. Stoica, and M. Zaharia (2010). “A View of Cloud Computing.” *Communications of the ACM* 53 (4), 50–58.

Barney, J. (1991). “Firm Resources and Sustained Competitive Advantage.” *Journal of Management* 17 (1), 99.

Benlian, A., M. Koufaris, and T. Hess (2011). “Service Quality in Software-as-a-Service: Developing the SaaS-Qual Measure and Examining Its Role in Usage Continuance.” *Journal of Management Information Systems* 28 (3), 85–126.

Ceccagnoli, M., C. Forman, P. Huang, and D. j. Wu (2012). “Cocreation of Value in a Platform Ecosystem: The Case of Enterprise Software.” *MIS Quarterly* 36 (1), 263–290.

Das, T. K., and B.-S. Teng (2000). “A Resource-Based Theory of Strategic Alliances.” *Journal of Management* 26 (1), 31–62.

Demirkan, H., H. K. Cheng, and S. Bandyopadhyay (2010). “Coordination Strategies in an SaaS Supply Chain.” *Journal of Management Information Systems* 26 (4), 119–143.

Dhanaraj, C., and A. Parkhe (2006). “Orchestrating Innovation Networks.” *Academy of Management Review* 31 (3), 659–669.

Flick, U. (2009). *An Introduction to Qualitative Research*. 4th ed. London, UK: Sage Publications.

Grover, V., and R. Kohli (2012). “Cocreating It Value: New Capabilities and Metrics for Multifirm Environments.” *MIS Quarterly* 36 (1), 225–232.

Han, K., W. Oh, K. S. Im, H. Oh, A. Pinsonneault, and R. M. Chang (2012). “Value Cocreation and Wealth Spillover in Open Innovation Alliances.” *MIS Quarterly* 36 (1), 291–316.

Hauff, S., J. Huntgeburth, and D. Veit (2014). “Exploring Uncertainties in a Marketplace for Cloud Computing: A Revelatory Case Study.” *Journal of Business Economics* 84 (3), 441–468.

Hill, R. C., and D. Hellriegel (1994). “Critical Contingencies in Joint Venture Management: Some Lessons from Managers.” *Organization Science* 5 (4), 594–607.

Hitt, L. M., and E. Brynjolfsson (1996). “Productivity, Business Profitability, and Consumer Surplus: Three Different Measures of Information Technology Value.” *MIS Quarterly* 20 (2), 121–142.

Iansiti, M., and R. Levien (2004). *The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability*. Massachusetts, Boston: Harvard Business Press.

Jacobides, M. G. (2005). “Industry Change Through Vertical Disintegration: How and Why Markets Emerged in Mortgage Banking.” *Academy of Management Journal* 48 (3), 465–498.

Lavie, D. (2006). “The Competitive Advantage of Interconnected Firms: An Extension of the Resource-Based View.” *Academy of Management Review* 31 (3), 638–658.

Lee, A. S. (1991). “Integrating Positivist and Interpretive Approaches to Organizational Research.” *Organization Science* 2 (4), 342–365.

Leimeister, S., M. Böhm, C. Riedl, and H. Krcmar (2010). "The Business Perspective of Cloud Computing: Actors, Roles and Value Networks" in: *Proceedings of the 18th European Conference on Information Systems* Pretoria, South Africa: .

Leong, L., D. Toombs, B. Gill, G. Petri, and T. Haynes (2014). Magic Quadrant for Cloud Infrastructure as a Service http://www.gartner.com/technology/reprints.do?id=1-1UM941C&ct=140529&st=sb accessed October 15, 2014.

Madhok, A., and S. B. Tallman (1998). "Resources, Transactions and Rents: Managing Value Through Interfirm Collaborative Relationships." *Organization Science* 9 (3), 326–339.

Markus, M. L., and C. Loebbecke (2013). "Commoditized Digital Processes and Business Community Platforms: New Opportunities and Challenges for Digital Business Strategies." *MIS Quarterly* 37 (2), 649–653.

Mohammad Masrurul, M. (2012). "An Overview of Strategic Alliance: Competitive Advantages in Alliance Constellations." *Advances in Management* 5 (12), 22–31.

Mohammed, A. B., J. Altmann, and J. Hwang (2010). "Cloud Computing Value Chains: Understanding Businesses and Value Creation in the Cloud" in: D. Neumann, M. Baker, J. Altmann, O.F. Rana (eds.), *Economic Models and Algorithms for Distributed Systems* Basel, Switzerland: Birkhäuser Verlag AG pp. 187–208.

Patton, M. Q. (2002). *Qualitative Research & Evaluation Methods*. 3rd Edition. London, UK: Sage Publications.

Penrose, E. (1959). *The Theory of the Growth of the Firm*. New York, USA: Wiley.

Porter, M. E. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*. New York, USA: Simon and Schuster.

Repschlaeger, J., R. Zarnekow, S. Wind, and K. Turowski (2012). "Cloud Requirement Framework: Requirements and Evaluation Criteria to Adopt Cloud Solutions" in: *Proceedings of the 20th European Conference on Information Systems* Barcelona, Spain: .

Ritala, P. (2012). "Coopetition Strategy – When Is It Successful? Empirical Evidence on Innovation and Market Performance." *British Journal of Management* 23 (3), 307–324.

Sarker, S., and S. Sarker (2009). "Exploring Agility in Distributed Information Systems Development Teams: An Interpretive Study in an Offshoring Context." *Information Systems Research* 20 (3), 440–461.

Sarker, S., S. Sarker, A. Sahaym, and N. Bjørn-Andersen (2012). "Exploring Value Cocreation in Relationships Between an ERP Vendor and Its Partners: A Revelatory Case Study." *MIS Quarterly* 36 (1), 317–338.

Satzger, B., W. Hummer, C. Inzinger, P. Leitner, and S. Dustdar (2013). "Winds of Change: From Vendor Lock-In to the Meta Cloud." *Communications of the IEEE Internet Computing* 17 (1), 69–73.

Schneider, S., and A. Sunyaev (2014). "Determinant Factors of Cloud-Sourcing Decisions: Reflecting on the IT Outsourcing Literature in the Era of Cloud Computing." *Journal of Information Technology*.

Shapiro, C., and H. R. Varian (2013). *Information Rules: A Strategic Guide to the Network Economy*. Harvard Business Press.

Sutton, S. G. K. (2008). "Risk Analysis in Extended Enterprise Environments: Identification of Critical Risk Factors in B2B E-Commerce Relationships." *Journal of the Association for Information Systems* 9 (4), 151–174.

Venkatraman, N., and Chi-Hyon Lee (2004). "Preferential Linkage and Network Evolution: A Conceptual Model and Empirical Test in the U.S. Video Game Sector." *Academy of Management Journal* 47 (6), 876–892.

Venters, W., and E. A. Whitley (2012). "A Critical Review of Cloud Computing: Researching Desires and Realities." *Journal of Information Technology* 27 (3), 179–197.

Wade, M., and J. Hulland (2004). "The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research." *MIS Quarterly* 28 (1), 107–142.

Waters, R. (2013). "Cloud Price War is Bad News for Technology Industry's Old Guard." *Financial Times*.

Weick, K. E. (1976). "Educational Organizations as Loosely Coupled Systems." *Administrative Science Quarterly* 21 (1), 1–19.

Williamson, P. J., and A. De Meyer (2012). "Ecosystem Advantage: How to Successfully Harness the Power of Partners." *California Management Review* 55 (1), 24–46.

Wu, X., X. Zhu, G.-Q. Wu, and W. Ding (2014). "Data Mining with Big Data." *IEEE Transactions on Knowledge and Data Engineering* 26 (1), 97–107.

Yin, R. K. (2009). *Case Study Research: Design and Methods*. 4th edition. Thousand Oaks, USA: SAGE Publications, Inc.