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THE ROLE OF TECHNOLOGY FOR SERVICE INNOVATION IN SHARING ECONOMY ORGANIZATIONS – A SERVICE-DOMINANT LOGIC PERSPECTIVE

Research paper

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Abstract

The role and influence of information technology related to business and value creation of a firm are discussed controversially. The question how technology can drive service innovations is especially crucial in highly competitive and quickly developing areas such as digital platforms – and at the same time not well understood. This study investigates the role of information technology for service innovation in sharing economy organizations. These organizations are digital platforms that conflate physical and digital service elements. Using a service-dominant logic perspective, we conduct an interpretive multiple-case study to gain a deeper understanding for types of service innovation in this area and the different roles that IT can play in these initiatives. Our findings reveal different areas for service innovation and thereby help identifying previously unexplored interdependencies between the service ecosystem and value co-creation. We furthermore find that organizations' choices on the role of IT are dependent on the level of heterogeneity and standardization of the mediated transactions. We derive four archetypes for the role of IT in service innovation that serve to explain how and why IT is exploited sharing economy organizations. The findings are translated into practical guidelines for managers of digital platforms.

Keywords: service innovation, role of technology, sharing economy, service-dominant logic.

1 Introduction

The role and influence of information technology (IT) related to business and value creation of a firm are discussed controversially. Some researchers consider IT as a commodity good and, therefore, it doesn't lead to a sustained competitive advantage (e.g. Shin, 2001; Carr, 2003). Others acknowledge the ability to leverage technical resources as competitive resource (e.g. Mata et al., 1995; Santhanam and Hartono, 2003; Bhatt and Grover, 2005). However, instead of viewing IT as an initiator of change, those studies have mostly considered IT as a tool or facilitator to achieve certain goals. At the same time, prior studies mainly focused on manufacturing firms, whereas studies on the role of IT in service firms remain limited. In the light of the ongoing trend towards services and the different role that IT plays in service firms (Bertschek et al., 2016), this shortage is surprising.

Digital platforms are a prime example for such service firms (Tiwana et al., 2010). In contrast to traditional businesses, platforms create value through connecting two (or more) formerly unconnected consumer groups and generating economies of scope in supply and demand (Gawer, 2014). One of the fastest growing areas of digital platforms centers on the "sharing economy". Sharing economy platforms facilitate the shared use of resources supported through IT (e.g. Cohen and Kietzmann, 2014;

Tussyadiah, 2016). These platforms are subject to both the dynamics of the physical and digital world (Constantiou et al., 2016). On the one hand they have to deal with issues of the physical world (e.g. handover of the shared resource), on the other hand the presence of network effects in the digital world leads to a dynamic and competitive environment (Eisenmann et al., 2006; Hagiu, 2009). This puts emphasis on firms' innovativeness on a service level to provide superior value. For platforms, such value creation shifts from internal to external servicing (Alstyne, 2016), namely from optimizing internal processes to facilitating external interactions between different parties. The value is generated in the use of innovations in a complex collaborative networked ecosystem (Vargo and Lusch, 2007; Häikiö and Koivumäki, 2016). Therefore, we apply a service-centred view for studying value creation and innovation in this context (Akaka and Vargo, 2014).

Service innovation in sharing economy platforms extends the scope of most other digital platforms because the offered services are often based on physical assets (Constantiou et al., 2016) and, therefore, involve close physical interactions between two parties participating in value creation (Kamal and Chen, 2016). Thus, services need to facilitate the connection between the digital and the physical world. Since platforms are systems of separately developed pieces of technology (Gawer and Cusumano, 2002), technology is a critical component in value creation in service systems (Maglio and Spohrer, 2008). However, it remains unclear, how service innovation for platforms can be driven by information technology and why some firms decide to exploit technology differently than others (Akaka and Vargo, 2014). In order to gain in-depth insights into the role of technology for service innovation, we investigate the benefits of information technology through its operant (initiator for change) and operand (enabling or facilitating) roles. Thereby, information technology is not viewed as a tool or product, but as a resource to trigger or initiate change (Nambisan, 2013).

Within this paper, we investigate the role of IT in service innovation for platforms. Data from seven cases of sharing economy organizations and their strategic decisions allow the exploration of our research question: *How does information technology contribute to service innovation in sharing economy organizations?*

In the following, we provide the theoretical basis for service innovation and perspectives on the role of IT in organizations. We then describe our research methodology and design applied in our study, followed by a detailed presentation and discussion of our findings. Our research paper concludes by summarizing the main findings and providing directions for future research.

2 Theoretical Foundation

2.1 Perspectives on Service Innovation

In the past decade, academic research on service innovation has increased substantially (e.g. Lusch and Nambisan, 2015; Witell et al., 2016). The growing number of publications from diverse fields like marketing (e.g. Ordanini and Parasuraman, 2011; Dotzel et al., 2013), economics (e.g. Cainelli et al., 2006; Dominguez-Péry et al., 2013), strategy (e.g. Dörner et al., 2011), and information systems (e.g. Bardhan et al., 2010; Barrett et al., 2015) underscore the interest on service innovation.

Research on service innovation has undergone major changes by shifting the focus from internal innovation resources and capabilities into a network or ecosystem centric view (Häikiö and Koivumäki, 2016). Coombs and Miles (2000) separate service innovation in three perspectives: assimilation, demarcation, and synthesis. The idea of the assimilation perspective is that service innovation is similar to manufacturing innovation and is driven by the development of new technology that contribute to the development of significant different service offerings (Coombs and Miles, 2000). This perspective aligns well with Schumpeter (1934) and his view of innovation (Witell et al., 2016). The demarcation perspective argues that service innovation is highly distinctive from innovation in manufacturing firms (Coombs and Miles, 2000) and that service innovation appears in a business relationship between two actors (Witell et al., 2016). In this perspective service innovation starts to loosen from a Schumpetari-

an view of innovation by focusing on inventions that are new to the firm, but is still focused on outcome (Witell et al., 2016). An invention new to the firm and not necessarily substantially new to the market can be considered as an service innovation (Hertog et al., 2011). Witell et al. (2016) argue that in the demarcation perspective innovation often means "small process adaption" for a firm. Therefore, in practice all service firms develop service innovations (Witell et al., 2016). In the synthesis perspective both product and processes can be part of the value proposition offered to customers as service innovation (Skålén et al., 2015). Service innovation can be described as being "created with a particular value proposition in mind, which enables the user of the service to create value for themselves or their community" (Cullen, 2008, p.255). In that sense service innovation can be a new process or its outcome that is new to the firm and creates value in use (Witell et al., 2016). In summary, recent research tend to develop from assimilation and demarcation approaches toward a synthesis approach (Akaka and Vargo, 2014).

2.2 Conceptualization of Service Innovation

Even recent studies adopting a more integrated or synthesis approach largely consider innovation in an traditional context of producer and consumer (Lusch and Nambisan, 2015). Therefore, a new devised framework for service innovation is necessary to overcome that issue. Additionally, Lusch and Nambisan (2015) state that studies implicitly deal with service innovation (e.g. Tilson et al., 2010; Tiwana et al., 2010; Yoo et al., 2010). A broader conceptualization of service innovation should consider the adapted perspectives of these studies since they reflect the key concepts of service innovation (Lusch and Nambisan, 2015). Lusch and Nambisan (2015) broaden the definition of service innovation as "the rebundling of diverse resources that create novel resources that are beneficial (i.e. value experiencing) to some actors in a given context; this involves a network of actors, including the beneficiary (e.g., the customer)" (Lusch and Nambisan, 2015, p.161).

According to Lusch and Nambisan (2015) service innovation can be conceptualized through three elements grounded in service-dominant (S-D) logic (Vargo and Lusch, 2004, 2007): (1) service ecosystem, (2) service platforms, (3) value cocreation.

A *service ecosystem* is defined "as a relatively self-contained, self-adjusting system of mostly loosely coupled social and economic (resource-integrating) actors connected by shared institutional logics and mutual value creation through service exchange" (Lusch and Nambisan, 2015, p.161). According to Lusch et al. (2010) "self-adjusting" often occurs by actors spontaneously sensing and responding to their continued market relevance and viability, which help to overcome the cognitive distance among the actors. The more content is digitized, the easier it is for actors to share information quickly and to adapt a shared worldview to ensure the ecosystem's survival (Lusch and Nambisan, 2015). "Loosely coupled" indicates that actors are relatively free to enter and exit the environment and form collaborations or exchanges with other actors (Lusch and Nambisan, 2015). In a sharing economy organization this can be a simple registration for the service. The broader role of the service ecosystem is to facilitate a common environment for value cocreation by a diverse set of actors, illustrated by an shared institutional logic (Lusch and Nambisan, 2015). In other words, the service ecosystem is a network of actors to provide an organizing structure for actors and network participation. For P2P ridesharing organization, for instance, the service ecosystem is the network consisting of drivers, riders, the organization itself and additional actors (e.g. an insurance company) sticking to a common worldview.

Lusch and Nambisan (2015, p.166) define a *service platform* "as a modular structure that comprise tangible and intangible components (resources) and facilitates the interaction of actors and resources (or resource bundles)". The service platform serves as a venue for service exchange and leverages resource liquefaction and enhances resource density (Lusch and Nambisan, 2015). The service platform provides an organizing structure for resources. In the P2P ridesharing case mentioned above, this is the digital platform the organization provides to offer and to share rides.

The third element to conceptualize service innovation is the *cocreation of value*. S-D logic states that all social and economic actors integrate resources to collectively create value. Therefore, actors that

benefit are always part of value creation (Lusch and Nambisan, 2015). Service ecosystems and service platforms enable actors (e.g. customers and suppliers) to cocreate value. This includes "processes and activities that underlie resource integration and incorporate different actor roles in the ecosystem" (Lusch and Nambisan, 2015, p.162). As an example, in a P2P ridesharing organization this could be the actual execution of the ride, where value is created for the driver and the rider.

2.3 Different Roles of Information Technology

We conducted a literature review on the role that IT can play for different organizations. For the sake of our study, we define IT as hardware and software a firm needs to use in order to achieve its business objectives (Laudon and Laudon, 2014). This includes not only computers and storage devices, but also software, the internet, mobile devices and other digital and communication technologies. We used a continuously iterated concept matrix for analysis and synthesis of the identified literature (see Webster and Watson, 2002, for more details on our literature review methodology). Based on the studies we aggregated different views on IT in organizations guided by the framework of Nambisan (2013), which separates the role of IT as operand and as operant resource. The role of IT as operand resource describes technology as a resource that an actor acts on to obtain support for executing a task. Therefore, IT acts as an enabler or facilitator for achieving a certain goal. Whereas operant resources are resources that act on other resources to produce effects (Nambisan, 2013). They act or operate on other things rather than being operated on (Vargo and Lusch, 2004) and are an initiator or trigger of change (Nambisan, 2013). The dual role of IT that emerged from our literature review is illustrated in Table 1.

The operand role of IT is the most prominently investigated in prior studies. Those studies mostly focus on IT as enabler and tool to reach operational goals (e.g. Chan, 2000; Eardley et al., 2008; Vannoy and Salam, 2010). This includes IT to support for operational efficiency and productivity (e.g. Gregor et al., 2006; Tallon, 2010), to enhance quality (e.g. Tallon et al., 2000; Bhatt and Grover, 2005; Oh and Pinsonneault, 2007), to reduce operating costs (e.g. Tallon et al., 2000; Rivard et al., 2006; Dewan and Ren, 2011), to achieve agility (e.g. Overby et al., 2006; Roberts and Grover, 2012; Chakravarty et al., 2013), to enable growth (e.g. Mitra, 2005; Oh and Pinsonneault, 2007; Dewan and Ren, 2011), to support core competencies (e.g. Ravichandran et al., 2005; Wang et al., 2012), to enable integration activities (e.g. Häikiö and Koivumäki, 2016), or to support business strategy (e.g. Chan et al., 1997) and service innovation (Plattfaut et al., 2015).

The minority of the considered studies mention IT as an operant resource. Gregor et al. (2006) and Eardley et al. (2008) describe IT as an driver for organizational change, whereas Tallon et al. (2000), Tallon (2010), and Vannoy and Salam (2010) discuss how IT can be a driver of changing industry and market practices as well as competitive actions. Akaka and Vargo (2014) and Häikiö and Koivumäki (2016) add another perspective by discussing IT as a trigger for creating new value propositions. Ghazawneh and Henfridsson (2013) consider digital technology as a trigger for innovation, whereas Chen et al. (2009) see IT capabilities as driver for providing innovative services.

Most of the considered studies focused on traditional firms (e.g. manufacturing). The fact that just few studies investigated the role of IT in a service context indicates that research on the exploration and scope of technology in service ecosystems is in an early stage. Chakravarty et al. (2013) and Plattfaut et al. (2015) focused on the facilitating and enabling role of IT, whereas Akaka and Vargo (2014), Chen et al. (2009), and Ghazawneh and Henfridsson (2013) investigated the operant role of IT in the context of digital services. Häikiö and Koivumäki (2016) study both the operand and operant role of IT for value creation without considering the service ecosystem and the service platform. To the best of our knowledge, no study combines the dual role of IT with the conceptualization of service innovation. We attempt to address this gap by analysing both the operand and the operant role of IT in all three perspectives of service innovation within one study.

Source	Role of information technology		Context
	Operand	Operant	
Akaka and Vargo (2014)		IT for creating new value propositions	Service ecosystems (Conceptual)
Bhatt and Grover (2005)	Quality of IT as competitive necessity		Manufacturing firms
Chakravarty et al. (2013)	IT as enabler and facilitator for organizational agility		B2B electronic marketplaces
Chan (2000)	IT as a to accomplish something and to make workload easier		Business Process Reengineering
Chan et al. (1997)	IT as supporter for business strategy		Financial and manufacturing firms
Chen et al. (2009)		IT capabilities for new and innovative services	Service delivery innovation
Dewan and Ren (2011)	IT as tool for cost reduction and scope economies		Fortune 1000 firms
Eardley et al. (2008)	IT as enabler for BPR	IT as driver for BPR	Business Process Reengineering
Ghazawneh and Henfridsson (2013)		IT to trigger innovation	Software ecosystems
Gregor et al. (2006)	IT for information an transactional efficiency	IT as a driver of change	Australian firms
Häikiö and Koivumäki (2016)	IT as facilitator for integration activities	IT for creating new value propositions	Service for multichannel commerce
Mitra (2005)	IT as enabler for growth in firms		Manufacturing trade
Oh and Pinsonneault (2007)	IT for cost reduction, quality improvement, revenue growth		Manufacturing firms
Overby et al. (2006)	IT as enabler for enterprise agility		Firms in general (Conceptual)
Plattfaut et al. (2015)	IT as support for service innovation		Service innovation performance
Ravichandran et al. (2005)	IT as support for core competencies		Fortune 1000 firms
Rivard et al. (2006)	IT for cost reduction		SMEs
Roberts and Grover (2012)	IT as facilitator for customer agility		U.S. firms
Tallon (2010)	IT for enhancing efficiency and productivity	IT to redefine banking practices	Small and large banks
Tallon et al. (2000)	IT for cost reduction, quality, improvement, speed and effectiveness	IT for changing industry practices	Fortune 1000 firms
Vannoy and Salam (2010)	IT as a service / tool to achieve goals	IT as trigger for competitive actions	U.S. manufacturing firm
Wang et al. (2012)	IT as support for core competencies		Chinese firms

Table 1. Studies investigating the role of IT

3 Research Design

3.1 Research Methodology

To uncover the roles of IT on service innovation in sharing economy organizations, we draw on case study research. Case study research is particularly suitable in this context for three reasons. First, it provides a way to analyse service innovations in an organization in a natural setting without any control over processes and participants, which allows us to understand the object of investigation in depth (Yin, 2009). Second, a case study approach is suitable to answer "how" and "why" questions of contemporary events (Yin, 2009). Third, our analysis includes interview data and other available documents (e.g. websites) of different organizations and therefore allows an analysis based on multiple sources of evidence (Eisenhardt, 1989). We follow a multiple-case study design (Yin, 2009) and employ an interpretive stance to understand the phenomena by exploring the subjective and intersubjective meanings of participants when they interact with their environment (Walsham, 1995). We are aware that investigations are shaped by predefined beliefs, interests and values of the researcher (Darke et al., 1998). With our multiple-case study approach and the interpretative stance we are able to deeply understand the role of IT in sharing economy organizations in their context without manipulation or explicit control of variables (Darke et al., 1998). The collection of data in multiple cases supports us in studying the phenomenon in different settings and enables cross-case analysis (Yin, 2009).

We choose the service innovation (Lusch and Nambisan, 2015) in sharing economy organizations as a unit of analysis. The aim of the study is to explore how IT contributes to service innovation for these kinds of organizations. The Oxford Dictionary (2016) excludes professional services (e.g. B2C car sharing), whereas others (e.g. Belk, 2014; Möhlmann, 2015) include these services in the sharing economy. Some authors see this phenomenon as an umbrella concept encompassing different related phenomena (e.g. Hamari et al., 2015; Barnes and Mattsson, 2016; Henten and Windekilde, 2016). Since the main idea behind the sharing economy is the capturing and redistribution of idling capacity (Daunorienė et al., 2015) and to make it accessible to others, leading to a reduced need for ownership (Richardson, 2015), we define sharing economy to cover the phenomenon as broad as possible for this study as an economic system in which assets and services are shared between individuals or between individuals and organizations for any kind of compensation by means of IT.

3.2 Data collection and analysis

We collected data from sharing economy organizations offering transportation services in the mobility sector. By focusing on one sector, the organizations are comparable in their environmental setting. All of them enable access to resources without the transfer of ownership, and charge a monetary fee for each transaction. However, the firms differ in their business models, allowing us to uncover the roles of IT for service innovation in different settings. We combined different sources of evidence and triangulated interview data with firm presentations and data extracted from newspapers and websites.

In a first step, in August 2015, we developed a semi-structured interview guideline (Eisenhardt, 1989; Orlikowski, 1993) based on the literature on service innovation (e.g. Barrett et al., 2015; Lusch and Nambisan, 2015), business models (e.g. Zott and Amit, 2010; Veit et al., 2014; Giessmann and Legner, 2016), organizational capabilities (e.g. Teece, 2007; Karimi and Walter, 2015) and IT (e.g. Sambamurthy et al., 2003; Vannoy and Salam, 2010). This guideline was used to conduct 13 semi-structured interviews with top level representatives of seven sharing economy organizations acting in Germany. The interviews were conducted, recorded, and transcribed between October 2015 and November 2016 and had an average length of 61 minutes. While all sharing economy organizations stem from the mobility sector to allow comparison across cases, their other characteristics differ widely to cover a broad spectrum of sharing economy organizations. Our sample includes two B2C car sharing services, one P2P car sharing service, one B2C scooter sharing service, one P2P ride-for-hire service, one P2P ride-sharing service, and one B2C ride-sharing service. To cover a broad spectrum of sharing

economy organizations, our sample ranges from two smaller startups with 1-5 employees, over two more mature companies with 6-20 employees, to three global players with 100-4500 employees. Three of the organizations started their business one up to three years ago, the remaining four companies run their business for five years or more.

We deductively developed a framework for the analysis of the interviews by combining the conceptualization of service innovation (Lusch and Nambisan, 2015) with the dual role of IT (Nambisan, 2013). To achieve a high quality data analysis we adhered to the principles of interpretative research by Klein and Myers (1999). A four step coding approach was applied to analyse the interviews: (1) identification of service innovations, (2) mapping, (3) linkage to the roles of IT, and (4) aggregation.

We first coded the interviews inductively regarding service innovations enabled, facilitated or triggered by IT. In a second step we mapped the identified service innovation to the conceptualization of service innovation by sorting it to one of the three perspectives of service innovation. Third, we linked the service innovation to one of the roles of IT by distinguishing between service innovations facilitated by IT and service innovations triggered by IT. At last, we applied in an iterative process the identified service innovations and connected them with existing theoretical concepts from literature (Orlikowski, 1993). The coding is exemplified by the following quote from the CEO of a P2P ride sharing organization:

"With our products we have to establish conditions […] that I step into the car of him [stranger] and ride with him from Berlin to Hamburg. This happens with ratings."

Obviously, the organization uses a technology (e.g. rating system) to generate trust among the actors (driver and rider) which could be considered as service innovation. Since the rating system reduces the uncertainty among a network of actors, this service innovation is mapped to the service ecosystem. At last, the innovation has to be assigned to a role of IT. The rating system is used to execute a task (e.g. generation of trust) and acts as a facilitator. Therefore, this innovation can be classified as operand resource. Together with other service innovations facilitating trust (e.g. profiles and pictures of the driver) the rating system could be aggregated to a category "trust among actors".

4 Results

This section describes the analysis of the role of IT for service innovation. We structured the results according to the conceptualization of service innovation by Lusch and Nambisan (2015). The results are summarized in Table 2.

4.1 Service Ecosystem

Our analysis shows that in the service ecosystem perspective the investigated organizations solely use information technology as an operand resource. IT enables and facilitates the service ecosystem in four different ways. First, IT is used as a facilitator to generate transparency of the created value and to communicate how and what value is created by using the service. For instance, this is achieved by stating advantages of using the service on the website of the organization:

"One […] challenge is to communicate that value is created through the intermediation of millions of people and that this [intermediation] cannot be accomplished by two guys out of a garage." (I8)

"The promise is to come from A to B […] at very low prices while being social and sustainable." (I7)

In a service ecosystem, the cognitively distant actors need a shared institutional logic to adopt a *shared worldview*. This includes a common set of business and cultural assumptions (Lusch and Nambisan, 2015). IT facilitates the control of the ecosystems to identify users violating the desired standard of the network due to inappropriate behaviour (e.g. harassment), the attempt to circumvent security features of the platform (e.g. identification of fake accounts), or undercutting of quality standards for service provision (e.g. extreme driving style). This, for instance, leads to excluding users from the service:

"There is no obligation to admit everyone [to the network]. If someone writes that he will only pick up women under 30 […] than this is not the right platform. […] This is inappropriate and, therefore, we block them [this kind of users]." (I6)

"This [user data] helps to decide in extreme cases, if a user has to be blocked from the platform, since he doesn't behave in a way that we want or that the majority of fellow human being expects." (I4)

Additionally, information technology (e.g. social media) is used to react on circumstances negatively influencing the shared worldview (e.g. wrong information about the service) or positively effecting a shared worldview (e.g. the charging of electronic vehicles):

"There are a lot of rumours and incorrect information. […] To be ready to always answer questions online, to conciliate or to deal with people, is central." (I8)

"The moment is to send a signal, especially through Facebook and other online media, that if you put the cars charging, it will be a better experience for the next customer. So we try to encourage customers to put them charging that way." (I10)

Another issue in the service ecosystem perspective is to *encourage actors to join the network*. Information technology can facilitate this activity by offering easy onboarding processes (e.g. user registration), cheap ways for marketing (e.g. social media and SEO), providing monetary incentives (e.g. discounts for new actors), or the reactivation of inactive users (e.g. CRM or push notification on smartphones). The following quotes illustrate this activity:

"The onboarding process works fully digitally including the verification [of driver licence]. I scan my license via the app, upload it, and then I receive automatically a digital verification." (I13)

"For marketing, of course social media like Facebook […] are very important aspects." (I11)

Another important role of a market intermediary is to provide trust (Weber, 2014). Some of the investigated organizations use several mechanisms facilitated by information technology to generate *trust among the involved actors* pointed by the following quote:

"Evaluation and ratings, trust, and background checks, as well as verification of persons […] that are major elements regarding technology." (I5)

Besides popular online reputation systems like ratings for transactions, user profiles, pictures of users and the shared resources, background checks (e.g. proof of driver license or certificates of good conduct) contribute to the creation of trust:

"We tell our users, that [...] it's not anonymous what happens here, several data will be verified and you will get a rating at the end of the ride." (I6)

Additionally, the collection of data (e.g. GPS tracking of a ride) and emergency features (e.g. in-app SOS buttons) support the creation of trust.

4.2 Service Platform

In the service platform perspective, the investigated organizations employed IT both as operand and as operant resource. As operand resource IT contributes to the provision of the digital platform, for optimization of resources, pricing, and market liquidity, whereas IT as an operant resource triggers the development of new services.

IT is used as operand resource to enable and facilitate the *digital platform* itself and contributes to the reliability, scalability, speed, flexibility, and usability of the digital platform. The dependency on technology for the digital platform is illustrated in the following quotes:

"Without technology it [the service provision] would not be possible." (I2)

"If the technology doesn't work, the entire rest doesn't work." (I12)

Furthermore, information technology contributes as facilitator to the *optimization of supply and demand*. To optimize the proportion of provided and demanded resources, the investigated organizations use target marketing (e.g. to increase supply of the shared resource):

"Depending on the utilization […] it becomes very specific. […] We need more drivers on a certain route at a certain time. […] Then we target our marketing to that area and try to address the users there more selectively." (I7)

They gather real time data of the shared resource (e.g. location or fuel) to optimize the amount of vehicles in a certain area, if the organization owns the shared resource, or to detect hotspot areas:

"If a customer […] didn't park the car with a quarter of the fuel tank, […] then I could send an employee to refuel." (I3)

In addition to the above mentioned options to optimize supply and demand, IT facilitates different *pricing strategies*. The investigated organizations used either IT to identify the willingness to pay of a customer, apply surge pricing, give price suggestions (e.g. automated calculated prices) to the resource sharer, or adjust prices depending on the time of the day:

"If you have high demand and the supply side cannot serve the demand, then the prices increase. […] Higher prices mean that first demand is decreasing, […] and second riders [supply side] get motivated to stay online or to get online, because they earn more money." (I4)

"We have the rule that prices we suggest are clearly below operating costs and even if a driver wants to increase the price, he can increase the suggested price only by a maximum of 50%." (I6)

IT also plays a facilitating role for increasing the *market liquidity*. Most of the investigated organizations connect their service to partners to increase the reach of potential customers on the supply and demand side. This is achieved by interfaces, for example to use APIs to enable data exchange with other service providers and to connect the service in booking portals and websites:

"We have an API […] where these corporations [online travel agencies] have access. They are able to retrieve our entire rides […] with information and you just have to click to get redirect [to the organization's platform]." (I7)

IT also facilitates opening the service for customers of other organizations using the same technology (e.g. other station-based car sharing providers) or cooperation with other mobility providers:

"We begin to connect ourselves as ecosystem for mobility, to get into […] booking systems, connect to airlines […] to get broader access." (I5)

As mentioned above, in the service platform information technology is also used as an operant resource. One organization used data mining on the shared resources to *discover novel opportunities for service provision*. By collecting huge amounts of data and identification of idling capacities new potentials for service provision (e.g. delivery services for food and parcels) were discovered:

"Once, the systems are running in the cities, you can strap on food delivery or parcel delivery" (I5)

4.3 Value Creation

In the value creation perspective, IT in our sample is also used as operand and operant resource. In the operand role IT facilitates the matching of supply and demand, adoption of internal processes to accommodate different actors, the interaction among actors, and an enhanced outcome transparency of a transaction. As operant resource technology triggers new user experiences.

As operand resource, IT contributes to the *matching of supply and demand* and, therefore, to the value creation itself. Most of the transactions moderated by sharing economy organizations theoretically could be performed without the usage of technology, but the IT enables an easy and extensive matching that facilitates the creation of value and the rapid development of the phenomenon:

"We have to assemble a technology which enables matching [of supply and demand] in an easy manner. […] In times with no internet, in Germany this was done by car sharing agencies. […] That was so complicated. Therefore, it didn't become a large phenomenon." (I6)

Additionally, the investigated organizations *adopted their processes to accommodate different actors*. For instance, by offering booking systems with online payments and automated billing or usability

features to support the connection of digital and physical resources (Constantiou et al., 2016), like opening of car sharing vehicles by smartphone, facilitates the execution of the transaction:

"[We offer] technical solutions for access to vehicles, […] that you can open the car with your smartphone, even if the car is parked in underground parking with no network connection." (I12)

"The debit occurs automatically via PayPal. […] I don't have to do anything for the payment." (I4)

The adaption of workflows to local conditions (e.g. special versions of the app for different countries) also facilitates the execution of the transaction:

"For user experience improvements, we adapt the entire workflows of the app. Partially regional, since customers in the USA are used to deal with an app differently than [customers] in Europe." (I9)

An important area of support in value creation is the facilitation of *interaction among actors* (Lusch and Nambisan, 2015). The investigated organizations use IT as operand resource to get in contact with customers directly or to support the interaction among actors involved in the intermediated transaction. IT, for instance, is used to gather direct feedback of the customer (e.g. for service improvements), to facilitate the complaint management (e.g. if the customer is not satisfied with the transaction or the service in general), or to proactively identify potential problem users, to contact them, and to take counter actions (e.g. training for drivers with bad ratings):

"In the beginning […] we had a kind of website, where [customers] could enter suggestions which other users could judge […]. Thereby, we got a lot of feedback regarding product extension." (I9)

"You can reply to every e-mail receipt […], no matter where you are, in every language and you will get redirected to employees able to speak the language and you can complain or give feedback." (I4)

"There is a cascade of offences someone can do and there are appropriate triggers [to take counter actions]. […] Then they [users with bad ratings] are convoked for extra trainings." (I5)

Besides the direct interaction with customers, IT is used to facilitate interaction among the involved actors to support the actual execution of the transaction. Booking systems with communication tools (e.g. chats), mechanisms for supporting the physical meeting of actors (e.g. maps to display location of the shared resource or to locate other actors) improve the transaction:

"If I can't display the exact location of a vehicle, the customer will always pass by and won't find it, that's the death of our business model." (I13)

"I see the name, the number plate, the kind of car, how far he [driver] is away from me, and I see him approaching me on the map. Then get into the vehicle and have already entered the destination." (I4)

Additionally, IT supports the handover of the shared resource (e.g. with smartphone support), illustrated by the following quote:

"You don't need necessarily a smartphone [for the handover of a vehicle], […] but you can do it with a digital handover by smartphone." (I12)

Lusch and Nambisan (2015) argue that IT can be important in enhancing transparency in value creation activities. Organizations exploiting IT to create trust among actors in the service ecosystem, also use IT as facilitator for *creating transparency of the outcome of a transaction*. This is achieved by displaying certain characteristics of the transaction which potentially could influence the perceived quality of the transaction (e.g. ladies only options, accepted luggage or detour) or the characteristics of the actual service provider (e.g. communication level of actors or driving style):

"You can say that you want to get picked up in front of your door, or you can say that you accept a five minute walk to get picked up. […] Everything is communicated via the app." (I11)

"You specified on your profile, that you don't smoke and that you like pets. […] Here you have three potential drivers, choose one." (I7)

Additionally, the transaction confirmation in case of special conditions (e.g. higher prices) contribute to the outcome transparency of a transaction and assure that the expectations of actors fit together:

"If the demand is high, the ride costs 1.2 or 1.5 times of the normal price. As user you have to state explicitly "yes" […] that later on you cannot claim 'I didn't recognize it [the higher prices]'." (I4)

We also find evidence for how information technology serves as an operant resource by triggering the *creation of unique user experience*. For instance, if the IT initiate new changes (e.g. unique algorithms) that enable to reduce the waiting time for transactions radically or to pool innovatively formerly non connected transactions to reduce costs for each of the involved actors:

"The system recognizes, when you are arriving […] and takes this calculation into account in advance […] to patch that with the next ride [of that driver]. […] Through this technology you will get a car which is closer to you. […] And that implementation of technology is hard to achieve." (I5)

Additionally, new technologies could trigger new options to connect physical and digital goods (e.g. special hardware for opening electronic scooters), illustrated by the following quote:

"We integrate an electronic data transmission system in the scooter. […] It's a challenge to operate that system with the existing [poor] power sources [in a scooter]." (I13)

Role of IT		Service Ecosystem	Service Platform	Value creation
Operand	Operation	Transparency of value Shared worldview Engagement in service	Digital platform Optimization of supply and demand (incl. pricing) Market liquidity	Matching of supply and demand Adapting internal processes Mechanisms facilitating interaction among actors
	Transaction Evaluation	Trust among actors		Outcome transparency
Operant			Development of new services	Unique user experience

Table 2. The role of IT for service innovation

5 Discussion and Conclusion

We provide insights for the role of IT in digital service innovation by offering qualitative data of sharing economy organizations and show that the role of IT is dependent on the heterogeneity of actors and shared resources and the intention of the organization to standardize the transaction.

A cross-case analysis shows that not all investigated organizations exploit IT as an operant resource in the service platform or in the value creation and not all organizations use IT as an operand resource for supporting the transaction evaluation. The cross-case analysis reviews four different archetypes for the role of IT as illustrated in Table 3 and discussed in the following.

All investigated organizations use IT as an operand resource for facilitating the operation of the service in all three perspectives on service innovation, for instance to create a shared worldview in the service ecosystem, to optimize the proportion of resources in the service platform perspective, or to facilitate interaction among actors in the value creation perspective. Solely organizations enabling the sharing of foreign resources (not owned by the organization) use IT to facilitate the transaction evaluation (e.g. to create trust among the actors or to enhance the outcome transparency of the transaction). Organizations exploiting both operand roles of IT without using IT as operant resource are described by the archetype *broad facilitator*, whereas organizations simply relying on the operand role of IT as service operation facilitator are referred to as *service operation facilitator*. Three of the investigated organizations apply IT as an operant resource in the value creation perspective (e.g. algorithms to provide new user experience) whereof one organization additionally uses IT as operant resource in the service platform (e.g. data mining to discover new value propositions). We call an organization using IT as operant resource in value creation perspective v*alue creation differentiator*, the organization exploiting both operant roles of IT *broad differentiator*.

Roles of IT / Cases	Operand		Operant		Sharing own resources	Archetype
	Service operation	Transaction evaluation	Platform differentiator	Value creation differentiator		
P2P ride sharing	X	X			No	Broad facilitator
B2C ride sharing	X	X			No	
P2P car sharing	X	X			No	
B2C car sharing	X				Yes	Service operation facilitator
B2C scooter sharing	X			X	Yes	Value creation differentiator
B2C car sharing	X			X	Yes	
P2P ride-for-hire	X	X	X	X	No	Broad differentiator

Table 3. Archetypes for the exploited role of IT

The archetype *service operation facilitator* seems to be suitable for organizations offering high standardized transactions by sharing of own resources (e.g. a B2C car sharing company) and strongly limited resources for technology development. Since the provider of the resource is known and the outcome of every transaction is standardized, there is no need for facilitating the transaction evaluation (e.g. trust among actors or enhancing the outcome transparency). In contrast to the other B2C car sharing service in our sample, the investigated car sharing service applying this approach offers a station-based car sharing model with regional focus. Therefore, the resources for developing or sensing of new (operant) technologies are limited. The following quote highlights this statement:

"We want to complete the local public transport [in the operating city] with car sharing. […] We will connect to others [car sharing providers], but that's not our core. We want to serve [name of city] and […] that is a different approach." (I1)

Organizations exploiting the *broad facilitator* approach intermediate resources owned by different actors without providing own resources. Due to the heterogeneity of actors (e.g. driving style or social characteristics) and resources (e.g. condition of the car), trust among actors and the outcome transparency of the transaction are very important aspects. Additionally, this kind of organization enables the sharing of personal resources with mostly high emotional or monetary value with the possibility to affect someone's life (e.g. the car itself or a service operated in a car). Even if technology could trigger smart and new ways to mitigate these issues and to reduce the necessity for personal interaction, users might prefer a high level of personal interaction or involvement in the transaction itself. The following quotes highlight the importance of personal interaction in transactions for broad facilitators:

"For all involved parties it's important to know, […] if that really is the registered person. […] The hirer wants to know, who is driving my car and the renter wants to know, whose car he rides." (I12)

"We know that for a lot of regular drivers the social aspect is very important. […] They meet some younger people, which they wouldn't get in contact normally, and have a nice conversation. […] That's really a central argument." (I8)

Our data depict that sharing economy organizations, although heavily based on technology, barely exploit IT as an operant resource. Organizations implementing IT as an operant resource for value creation seem to focus on standardizing the transaction and, thereby, increasing efficiency of their service and reducing the personal interaction of the involved actors. First, organizations in our sample achieve a high standardization of the transaction by providing own, homogenous resources for sharing. As mentioned above, therefore, there is no need for facilitating transaction evaluation. Second, to additionally increase the efficiency of the service this kind of organization needs to enhance the connection of the digital and physical world. To connect actors with the physical resource used for the transaction, *value creation differentiators*, for instance, develop unique hardware to connect vehicles with con-

sumers or unique algorithms taking into account the location of actors or resource for a more efficient matching and reducing the need for personal interaction, illustrated in the following:

"You press [a button], go down the stairs […] and if you arrive downstairs, it [the car] goes on ahead. […] There is no need to talk [to the driver]. […] You enter the destination and in the end the app is handling the routing and there is no need to handle money." (I5)

We identified also an archetype exploiting IT as an operant resource both in the service platform perspective and the value creation (*broad differentiator*). Organizations following that approach seem to strive for standardization and efficiency of their transactions and reducing the personal interaction, although not sharing own resources. Unique algorithms for increasing efficiency and reducing the need for personal interaction are operant resources in the value creation perspective. Additionally, IT is used as an operant resource in the service platform perspective (e.g. data mining) to discover novel value propositions. One explanation could be, that due to high investments to achieve efficiency in the system other options for generating revenue are necessary and to achieve liquidity in the system to make the business model work in the long run. As a result of the usage of foreign resources, mechanisms for enhancing the transaction evaluation (operand) are preferable for this kind of organization.

Summing up, it became apparent that the more the transaction gets standardized and the more the focus of the business model is dependent on efficiency, the more IT acts as an operant resource.

This study aims at contributing to research in two ways: First, we enrich the understanding of digitally-enabled service innovation by uncovering different areas for service innovation within the S-D framework. The more fine-grained understanding of those areas enabled us to identify previously unexplored dependencies between service innovations across perspectives of the framework, namely between the service ecosystem and value creation for transaction evaluation. Second, we provide an understanding for how and why IT is exploited by sharing economy organisations. We discovered four archetypes for the role of IT in service innovation. For sharing economy organisations bridging physical and digital services, it appears that the choice for a particular role of IT is conditional on the level of heterogeneity and standardization of the mediated transaction. Thus, IT-driven service innovations are exploited to overcome the unique restraints that sharing business models can entail.

Our study highlights certain roles of IT applied in sharing economy organizations and provides insights for technology and platform development of these firms. Managers of these organizations could use our findings to guide their decisions on whether or not to invest in IT-driven service innovations and to specify areas for new developments. Practitioners could use the areas for service innovation and the role-archetypes to identify industry norms and to compare their business with competitors.

Yet, we need to acknowledge some limitations to our study. First, we focused on sharing economy organizations in Germany in the mobility sector. Although the results might be different for other countries or sectors, we chose a sample within the same regulatory system and industry to ensure comparability of the findings. Second, since we are using an interpretive qualitative stance, we acknowledge that reality is socially constructed and collected data is subject to human interpretation and, therefore, our results are not generalizable. But, instead of striving for statistical generalization our findings contribute to understanding the phenomenon in its specific context (Orlikowski, 1993).

The exploration of the role and scope of IT in service systems is in an early stage (Akaka and Vargo, 2014). Studies could use our findings to make the further examination of this phenomenon more manageable by allowing researchers to delimit their work to certain archetypes. Additionally, this provides a first basis for generalization (Bailey, 1994) of the role of IT in service innovation in further works.

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