Exploring the phenomenon of innovating value co-creation mechanisms – An empirical study in the electrical power sector

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ABSTRACT

Recently, the creation of value—one of the most fundamental aspects of economic actors—has begun to undergo a fundamental shift toward a heavily interdependent endeavor. The profound ramifications of digitalization and societal trends have formed a plethora of interdependent value creation formats such as networks, platforms, and (eco)systems. Subsequently, firms and other economic actors are confronted with new logics of creating value. As an emerging field of research, many questions remain to be explored and theoretical foundations to be determined, specifically regarding how firms can manage value co-creation.

Against this backdrop, this dissertation empirically addresses the questions of how to purposefully use the perspective of interrelated value creation and capture in segmenting industries, how to manage resources across firm boundaries for value co-creation, and how to adapt processes of value co-creation for varying contexts.

Accordingly, the first part of this thesis applies a categorization process to business models as representations of value capture and value creation to present an analytical tool and starting point for the study of value co-creation mechanisms. It identifies 25 exemplary archetypes in the electrical power sector as well as corresponding strategic dimensions to analyze and replicate these representations. The second part investigates how firms can actively manage resources across firm boundaries to create novel forms of value co-creation. It finds four generic patterns and links them to firm characteristics and their capabilities. Additionally, it sheds light on the importance of the specifics of value co-creation relationships to manage resources across firm boundaries. It further gives nascent insights into the importance of resources as governance mechanisms. The third part studies the context-dependency of value co-creation mechanisms and identifies the characteristics of two distinct overall processes that can be depicted as two end-points of a continuum. In particular, this study gives insights into the necessary conditions for related value co-creation outcomes and thus can help managers to purposefully design their value co-creation processes contingent to its contexts.

Overall, this thesis provides new, in-depth insights into an increasingly relevant field of innovation and strategic management research. It is among the first to empirically study the mechanisms of value co-creation while building on the most recent conceptional developments in that field. It provides tools and guidance for management practice in the electrical power sector and beyond as well as advances the field of value co-creation research. Furthermore, it gives rich insights into future directions in an evolving research field.

KURZDARSTELLUNG

In den letzten Jahren unterzieht sich die Erzeugung von Mehrwert – einem der zentralsten Aspekte ökonomischer Akteure – einer fundamentalen Verschiebung hin zu stark interdependenten Formen. Viel diskutierte Beispiele dieser neuen Formen sind unter anderem Geschäftsnetzwerke, Plattformen oder Geschäftsökosysteme, welche teilweise ganze Industrien neu definiert haben. Diese neuen Formate haben zur Folge, dass sich Unternehmen und andere ökonomische Akteure mit einer gänzlich neuen Logik der Werterzeugung konfrontiert sehen, in der Mehrwert durch das aktive Zusammenspiel vieler Akteure erzeugt wird.

Die Neuartigkeit des Phänomens hat zur Folge, dass in diesem neuen und aufstrebenden Forschungsbereich noch zahlreiche Fragestellungen zu erkunden und theoretische Grundlagen zu legen sind. Dies trifft insbesondere auf die Frage zu, wie Unternehmen gemeinschaftliche Werterzeugung (value co-creation) managen und organisieren können.

Vor diesem Hintergrund beschäftigt sich diese Dissertation empirisch mit der Frage, wie die ‚value co-creation Perspektive' zielgerichtet genutzt werden kann, um Industrien zu segmentieren, wie Ressourcen über Unternehmensgrenzen orchestriert werden können um gemeinsame Werterzeugung zu erzielen, und wie Prozesse gemeinschaftlicher Werterzeugung für unterschiedliche Kontexte angepasst werden müssen.

Die Dissertation widmet sich diesen Lücken und somit im ersten Teil der Frage wie die Perspektive helfen kann, Wettbewerb in Industrien neu zu verstehen. Dabei werden für den Elektrizitätssektor 25 Archetypen identifiziert, die dazu dienen, Wertschöpfungsmodelle zu analysieren, replizieren und innovieren. Der zweite Teil untersucht, wie Firmen unternehmensexterne Ressourcen vieler Partner aktiv managen können, um darauf aufbauend neuartige Formen der gemeinschaftlichen Werterzeugung zu schaffen. Der dritte Teil untersucht die Kontextabhängigkeit gemeinschaftlicher Werterzeugungsmechanismen und identifiziert die Charakteristiken von zwei Prozessen, die als Enden eines Kontinuums gesehen werden können. Zudem verbindet er Kontextfaktoren mit korrespondieren Werterzeugungsergebnissen und kann daher Managern helfen, zielgerichtet kontextspezifische Werterzeugungsprozesse zu gestalten.

Insgesamt bietet diese Dissertation neue und detaillierte Einsichten in ein zunehmend relevantes Feld des Innovations- und Strategischen Managements. Die Dissertation gehört zu den ersten, welche empirisch die Mechanismen der gemeinschaftlichen Werterzeugung untersucht, während sie auf den neuesten konzeptuellen Erkenntnissen dieses Feldes aufbaut. Die Dissertation stellt Werkzeuge und Handlungsempfehlungen für Manager bereit und entwickelt des Forschungsfeld „value co-creation" weiter.

OVERVIEW

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LIST OF ABBREVIATIONS

API	Application Programming Interface
B.	Billion
BoP	Base / Bottom-of-the-pyramid
BTU	British Thermal Unit
CO_2	Carbon Dioxide
DES	Distributed Energy Source
e.g.	exempli gratia (for example)
EV	Electric Vehicle
GHG	Green House Gases
IB	International Business
i.e.	id est (that is)
LCOE	Levelized Cost of Electricity
Mio.	Million
MNC	Multi-National Cooperation
PV	Photovoltaic
U.K.	United Kingdom
U.S.A.	United States of America
VCC	Value co-creation
VPP	Virtual Power Plant
VRIN	Valuable, rare, inimitable, non-substitutable

1. INTRODUCTION: INNOVATING SYSTEMS OF VALUE (CO)CREATION

> "The rise in coordination possibilities, enabled by the rapid progress of information and communication technologies, have spurred a boom of interest in, and conceptualizations of, strategy in the context of interdependence. While these have surfaced a multitude of important strategic choices, the impact of the structure of value creation has remained outside their focus." (Adner, 2017, p.50).

1.1. MOTIVATION AND RELEVANCE OF THE RESEARCH TOPIC

Electricity is the most important energy carrier in modern life, enabling a comfortable, healthy, and prosperous life enjoyed by many people around the world. Along with these immense benefits, however, come the undesirable environmental externalities (such as greenhouse gas (GHG) emissions, land erosion, and water pollution) associated with electricity production. A system-wide change to a scheme with less externalities is necessary, and some countries have already envisioned and started to implement these changes. At its core, it is nothing less than a complete overhaul of the basic idea of how electricity is produced, distributed, and consumed. In this process, the very fundamentals of how value is created needs to be reconstructed. Moving from a paradigm that has been characterized as a pipeline (Van Alstyne, Parker, & Choudary, 2016), a linear energy value chain (Hall & Roelich, 2016), as well as large scale (Bryant, Straker, & Wrigley, 2018), and bulk generation (Wood & Wollenberg, 1996) toward a system described as small-scale (Walker, Hunter, Devine-Wright, Evans, & Fay, 2007), decentral (McKenna, 2018; Narula, Nagai, & Pachauri, 2012), virtual (Othman, Hegazy, & Abdelaziz, 2015) and volatile (Bryant et al., 2018) requires enormous changes. By logical deduction, this calls for a plethora of innovations in various areas and levels of the socio-technical system. While many levels in this context, such as technological or policy innovations, have been studied for decades in this context, the needed innovations in value creation still provide room for an improved understanding. Understanding how new forms of value creation will perform can help this transition to materialize and thus presents a central piece of the puzzle. Many recent changes in technology, regulatory changes, and new gestalts of innovation and international competition form the foundation of pressure for innovating value-creation mechanisms. At the same time, changes in the mechanisms of value creation are not confined to the electrical power sector, but can be seen in many other industries as well and lead to a wide area of study and increase in knowledge on the phenomenon (see Chapter 1.2). Studying these changing mechanisms can thus be funda-

mental to understand many changing industries and form strategies and management responses to account for these changes.

This chapter outlines the ongoing—and, at times, drastic—changes that make innovation and specifically innovation in and toward systems of value co-creation, a necessary imperative in the energy sector. It outlines the relevance of the topic itself and the motivation for the study of value co-creation mechanisms in the energy sector.

The chapter is structured as follows: First, change drivers in the electrical power sector are introduced and their direct outcomes are briefly explained (1.1). Then, an introduction to the current state of the art in value co-creation research is given (1.2) and an outline of the research questions is presented (1.3). Structurally, the thesis can be depicted as presented in Figure 1-2. The circled numbers indicate the chapters that cover the topics.

1.1.2. INNOVATION IMPERATIVE

The need of organizations and sectors to constantly adapt products, processes, and services has often and concurrently spurred the science of creative destruction, invention, change, and, ultimately, innovation. Both business folklore and science have seen an exorbitant increase in the number of publications around the topic. By way of example, Figure 1-1 depicts the number of scientific publications in the Web of Science with "innovation" in the title from 1939 onwards, when Joseph Schumpeter famously coined a chapter of "The Theory of Innovation."

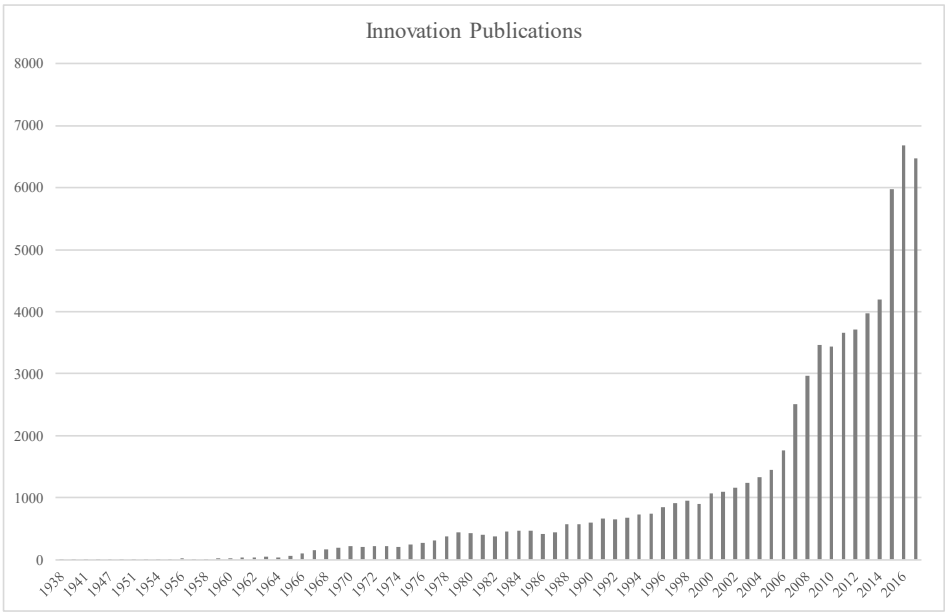

Figure 1-1 Scientific publications containing "Innovation" in the title[1]

[1] Based on Web of Science, 2018. 1939 was chosen as starting date as Schumpeter inaugurated the term innovation in his book, *Business Cycles*, which includes a chapter on "The Theory of Innovation"."

On the one hand, famous and successful entrepreneurs and managers have repeatedly argued for the imperative of innovation to stay ahead. See, for example, Steve Jobs: "If you don't cannibalize yourself, someone else will" (Isaacson, 2011) or Jeff Bezos' letter to the shareholder "Day 1" philosophy. On the other hand, the rapid decline of once immensely successful, traditional companies such as Kodak, Nokia, Polaroid, Motorola, or Xerox reminds business leaders of the costs and risks of non-innovation—and gives researchers material to study. Ultimately, innovation poses a perennial management challenge (Posner & Mangelsdorf, 2017).

General drivers of this challenge are equivocal and attributed to a combination of:

- ***increasing pace of technological change***: Although there is no consensus on how to measure innovation (Brenner & Broekel, 2011; Coombs & Miles, 2000; K. Smith, 2005), and hence no consensus on the speed of technological change and innovation, there is a wide consensus that we are living in an age of continual disruptions by technology (Kumaraswamy, Garud, & Ansari, 2018). Firms are continuously disturbed by technological changes that re-order the ways in which they and their ecosystems operate (Kumaraswamy et al., 2018);
- ***regulatory changes and policy makers***: stimulating economic growth through innovation-enabling policies as can be seen with the OECD report on "The Innovation Imperative. Contributing to Productivity, Growth and well-being" (OECD, 2015) or G20's "Innovation Action Plan." The last decade has witnessed a steep incline in policy instruments targeting innovation (Edler & Fagerberg, 2017) and an accordingly increasing number of public-sector organizations dedicated to innovations (Ezell, Spring, & Bitka, 2015).
- ***increasing international competition***: "Many more brains are at work now than were 100 years ago: American and European inventors have been joined in the race to produce cool new stuff by Japanese, Brazilian, Indian and Chinese ones" (Economist, 2013), which, in turn, also increased the global pressure for innovation (Williamson & Yin, 2014);
- ***new and unforeseen gestalts of innovation and convergence***: This includes disruptive innovation (Christensen, 2013; Christensen, Raynor, & McDonald, 2016; Christensen, Suárez, & Utterback, 1998), business model innovation (Gassmann, Frankenberger, & Csik, 2014; Wirtz, Pistoia, Ullrich, & Göttel, 2016; Zott & Amit, 2010) accelerated, low-cost innovation, and reverse or frugal innovation (Williamson & Yin, 2014; Zeschky, Winterhalter, & Gassmann, 2014) in combination with the increasing pace of technological change bring about the *conver-*

gence of sectors and cyber, physical, and economic performance (Muhanji, Flint, & Farid, 2018);

Moreover, studies find that this innovation imperative is not restricted to certain sectors, but will affect every sector sooner or later (Abbosh, Savic, & Moore, 2018; Beck & Libert, 2018; IMD, 2017) and calls for sector-specific innovation idiosyncrasies that have been subject to study already (Jacobides, Knudsen, & Augier, 2006; Weerawardena, O'Cass, & Julian, 2006).

In sum, these change drivers are also present in the electrical power sector (see Chapter 1.1.3.) and create an innovation imperative in the electrical power sector that does not stop to question the basic mechanisms of value creation. In the following sub-chapters these changes and their theory-related outcomes are explained in further detail.

1.1.3. THE ENERGY SECTOR IS FEELING THE HEAT

Although the energy sector—and specifically the electrical power sector—has not been considered immensely innovative in the last decades (Forbes, 2018b; Newell & Henderson, 2009), several of the aforementioned innovation drivers are present concurrently in the sector at the moment: regulatory activities in many countries, increasing pace of technological change, new gestalts of innovation, and, to some extent, international competition (see Figure 1-2).

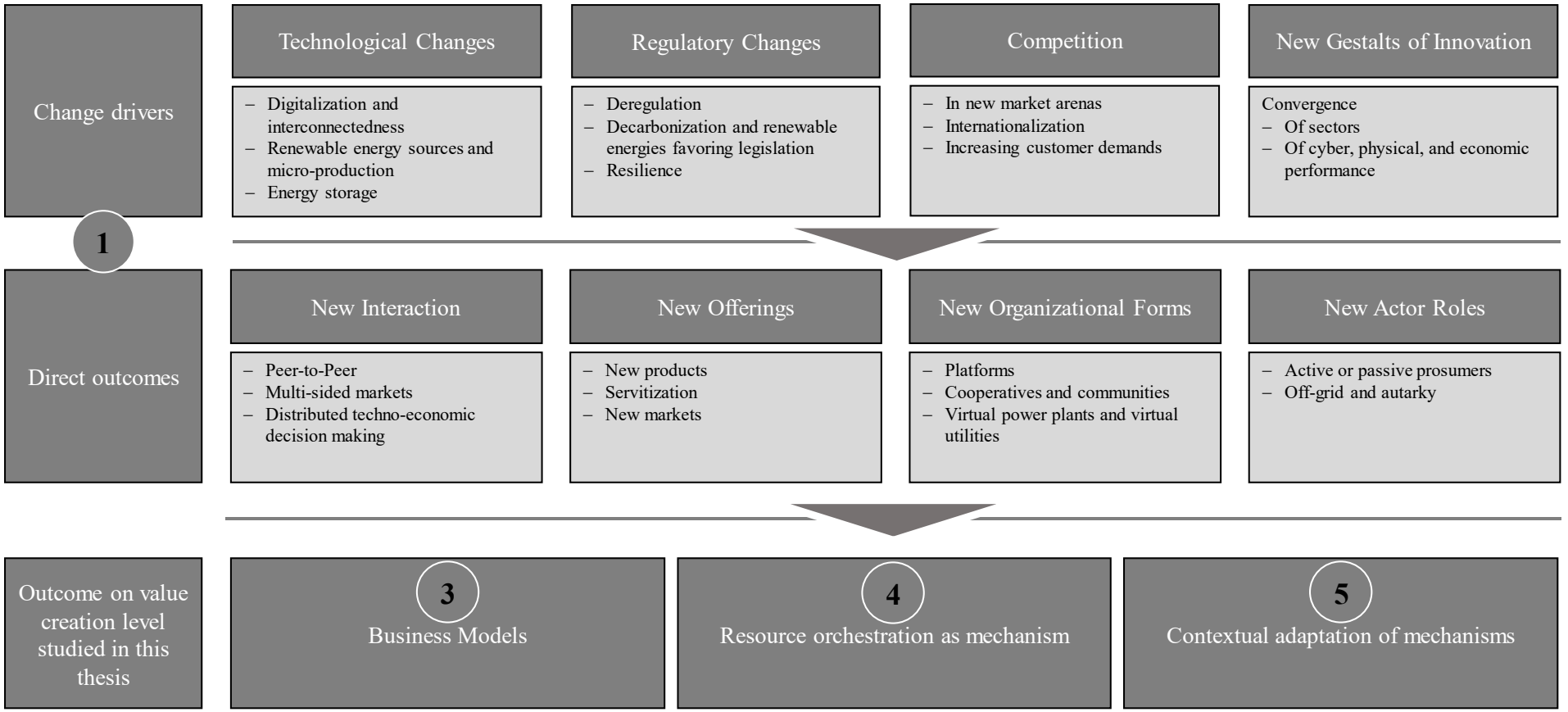

Figure 1-2 Structural composition of thesis

1.1.3.1. CONCURRENT CHANGES: INNOVATION DRIVERS

Regulatory activities

Despite its beginnings, where the electricity sector and the utility companies within competed for customers with many different technologies (Bakke, 2016), the sector soon became regulated (Bakke, 2016; Hirsh, 1999). In the 1910s there was a broad consensus that by regulating utilities almost all stakeholders win (Hirsh, 1999). Since then the electrical power sector has been under the strong influence of regulators (Bakke, 2016) and regulatory activities have a substantive influence on the need for innovation and change in the sector.

As many characteristics of electricity supply fall under the economic category of a natural monopoly, where the most efficient number of firms in an industry is one, regulators focused on building regulated monopolies to prevent market abuse (Joskow, 2007; Knieps, 1993). Uncontrolled and unorganized electricity markets gradually became institutionally legalized around the globe in the early 20th century (Sepulveda, 2016). However, in many legislations utilities were exempt from basic cartel laws that allowed for long-term concession and demarcation agreements (Bakke, 2016; Joskow, 2008).

Since the liberalization of electricity generation began in 1982 in Chile (Kessides, 2012), many countries have decided to introduce competition in their electricity industry to achieve greater economic efficiency (Jamasb & Pollitt, 2005). For example, the EU introduced basic directions for minimum standards for regulation in 1996; the German energy law to liberalize the market was amended in 1998; in the UK the Electricity Act to introduce privatization and restructuring of the electricity industry received assent in 1989; and, as a relative latecomer in liberalization efforts, Switzerland partially opened its electricity market in 2009 (Department for Business Energy Industrial Strategy, 2018; Die Bundesregierung, 2018; State, 2018; UVEK, 2018). Research shows (Waddams Price, 2005) that this process has reduced the costs of service and other inefficiencies associated with the monopolistic behavior of the traditional vertically integrated utility, but at the same time changed the industry structure completely. Next to market liberalization reforms, climate protection actions and security concerns (Department for Business Energy Industrial Strategy, 2018; Die Bundesregierung, 2018) led to regulations to reduce carbon-heavy, such as coal and gas, as well as nuclear power production. Widely, this decarbonization regulation has led to subsequent regulatory changes to promote the installment and integration of renewable energy sources into the energy mix and physical grid (Rockström et al., 2017). The Swiss *Energiestrategie 2050* (energy efficiency, increase of renewables, withdrawal from nuclear power, and upgrading the electric grid), the German *Energiewende* (increase of renewables, withdrawal from nuclear power, flex-

ible electricity markets, energy efficiency, and upgrading of electric grid), the UK's *Clean Growth Strategy* (amongst others: energy efficiency, increase of renewables, phase out of unabated coal, decarbonization of transport) or the *New York State Energy Plan* (by 2030: 40% reduction in greenhouse gas emissions from 1990 levels, 50% electricity will come from renewable energy resources, 600 trillion BTU increase in statewide energy efficiency) all outline the impacts on the current electricity system by regulations. As many of the physical and institutional logics of renewable energy sources is exactly reverse to conventional electricity production, these regulatory requests pose demanding challenges on the whole socio-technical system of energy provision and consumption and the basic assumption of value creation mechanisms.

Technological changes

While the core of the electrical power sector's physical laws and constructs (current, wires, voltage) remain constant, many adjacent technological aspects have seen tremendous changes and technological progress in the last decades. On the electricity production side, technological and process innovation decreased the LCOE of renewables recognizable to even below the levels of fossil fuel generation (Fraunhofer, 2018). We see a comparable increase in technological efficiency equal to what was already witnessed in the early 1900s where the efficiency of the first central coal-fired power plants was about 2% and twelve years later was already at about 12% efficiency (Bakke, 2016, p. 72). In 2018, according to a recent study, LCOE for large scale PV was as low as 3,71 €cent/kWh to 4,95 €cent/kWh and in range between 3,99 – 8,23 €cent/kWh for onshore wind turbines in Germany (Fraunhofer, 2018). This represents an 86% decrease of costs from electricity from solar between 2009 – 2017 (Lazard, 2017). This cost level is significantly below the average cost of energy for private households and below the costs of electricity production from fossil fuels and is expected to decrease even further (Fraunhofer, 2018). Next to that, emerging renewable energy sources technologies such as marine energy, concentrated solar photovoltaics, enhanced geothermal energy, cellulosic ethanol, and artificial photosynthesis show promising results already (Ellabban, Abu-rub, & Blaabjerg, 2014; Hussain, Arif, & Aslam, 2017). At the same time, changes in the economics (Freeman, Drennen, & White, 2017), installed capacity, and technologies of battery storage are prepared to change the logic of energy production, storage and provision (Schmidt, Hawkes, Gambhir, & Staffell, 2017).

Additionally, the electricity sector is confronted with the introduction of many "smart" technologies on multiple levels of the system such as grid and micro-grid, home

or city (Anaya & Pollitt, 2017; Erlinghagen & Markard, 2012a; Jamasb, Thakur, & Bag, 2018). Similar to other sectors, these technologies impact the range of possibilities to monitor, observe, automate, and communicate within the system (Jamasb et al., 2018). In the electricity sector, it specifically brings about the possibility for two-way communication and two-way flow of power (Güngör et al., 2011) through advanced control and decision-making functionalities and new possibilities of products and services (K. Zhou, Fu, & Yang, 2016; K. Zhou, Yang, & Shao, 2016). Other emerging technologies such as blockchain or ubiquitous artificial intelligence can further impact the sector in the future (Jha, Bilalovic, Jha, Patel, & Zhang, 2017; Li et al., 2018).

Finally, adjacent developments in regulation and technological innovation increase the electrification of transportation and require fundamental upgrades to electricity infrastructure in the near future. As EVs require 0.2 – 0.3 kWh of charging power per mile of driving (Ipakchi & Albuyeh, 2009), an increase of electrification of the transport sector poses challenges on the electrical power sector both in terms of peak loads as well as on the current capacities. Furthermore, electrified transportation potentially complicates power system operations: be it in balancing, line congestion, or voltage control (Andersen, Mathews, & Rask, 2009; M. Miller, 2018). In sum, many of these new technological possibilities have the potential to alter traditional forms of value creation.

New gestalts of innovation and convergence

Traditionally, the electrical power sector and its actors have been characterized by their low levels of R&D spending (Costa-Campi, García-Quevedo, & Trujillo-Baute, 2015), their generally closed innovation behavior (Greco, Locatelli, & Lisi, 2017), and their relative failure to achieve successful innovations (T. Foxon et al., 2005; T. Foxon & Pearson, 2008; Negro, Alkemade, & Hekkert, 2012). Yet, the described regulatory and technological changes bring about the need for new architectures of innovation such as service innovation (Bertoldi, Rezessy, & Vine, 2006; Marino, Bertoldi, Rezessy, & Boza-Kiss, 2011), open innovation (Greco et al., 2017), business model innovation (Hall & Roelich, 2016; Richter, 2012), and system-transforming or networked innovations (Erlinghagen & Markard, 2012a; Green & Newman, 2017; Negro et al., 2012; Rehm, Goel, & Junglas, 2016). The almost concurrent occurrence of these different gestalts of innovation can pose overwhelming stress on firms, managers, and actors (Edmunds & Morris, 2000; Hautz, Seidl, & Whittington, 2017). Further, these changes in innovation behavior bring about a conversion of sectors (Furr & Shipilov, 2018; Jacobides, Cennamo, & Gawer, 2018) and ultimately new models of value creation.

(International) competition and convergence

With the exceptions of international energy exchanges and spot markets and minor international competition in the unified European market, the core of electricity provision is still under limited (international) competition. However, as the core players of the electrical power sector move toward extended offerings in mostly unregulated market arenas to flee stagnating or decreasing revenues in core business functions, they are confronted with increasing competition (N. Kim, Lee, Kim, Lee, & Suh, 2015). According to recent studies, many electrical power providers and utilities plan to transform or have already transformed their businesses toward energy management services such as sensor-based energy monitoring systems, software-based data analytics, facilities management services (Deloitte, 2018; Strategy&, 2017), smart services (PwC, 2017), as well as building business models around data analytics and pricing strategies to tailor energy-related services to each customer's interests (Strategy &, 2017), and expanding into fields such as electrified mobility (EY, 2015, 2018; PwC, 2017), sector coupling (PwC, 2017), telecommunications (PwC, 2017), or municipal full-service providers (EY, 2015; PwC, 2017). At the same time as the traditional players of the electrical power sector are integrating their business, both in moving forward and laterally, the competitive landscape in the electrical power sector can be impacted by firms of the very same players in the targeted adjacent arenas as they move into the electrical power sector, contributing to a potential threat of increasing international competition.

1.1.3.2. SECTORAL RESISTORS

In addition to the concurrent changes that impact the electrical power sector and call for an increasing rate of innovation, the sector faces several specific barriers and boundaries to innovation (Holdren, 2006) that need to be considered when studying changing mechanisms of value co-creation.

Implicit guiding boundaries: The energy trilemma

The sector representatives and policy makers are pursuing innovations under the restricting tension of the energy trilemma (e.g., Department for Business Energy Industrial Strategy, 2018; Die Bundesregierung, 2018; UVEK, 2018). The energy trilemma, in essence, depicts the challenge of balancing competing demands of affordable, secure, and sustainable energy (Heffron, McCauley, & Sovacool, 2015). In this form, systemic innovations need to take all three perspectives into account and can hardly move to one extreme of this tension. Broad discussions in science (e.g., Büsgen & Dürrschmidt, 2009; Frondel, Ritter, Schmidt, & Vance, 2010), public (e.g., Flauger, 2017; Wetzel, 2018), and government (e.g., BMWi, 2018) on the effect of increased renewable energies on energy prices and reliability serve as a good example of these boundary conditions—especially how the need for energy security poses challenges on innovative product development. "Always beta," "rapid prototyping," or "design thinking" is often limited by regulatory requirements. The introduction of smart meters as core infrastructural technology for the future grid in Germany showcases this. To account for the energy security requirement, several German regulatory bodies define requirements or certify the hardware, software, and processes (Bundesnetzagentur, 2018). The outcomes are innovation processes that are guided by many external boundary conditions.

Physical restrictions

The electrical power system is a complex system of supply and demand where the available supply and the demand need to be matched in very narrow boundaries. This requirement is rooted in a product that has very limited storage reserves due to current technical restrictions of electricity storage. Electricity is surprisingly hard to store, especially compared to other commodity markets, and thus real-time match-making is a key requirement. The almost real-time matching is done through reserves (spinning, primary, secondary, tertiary). This physical restriction needs to be considered among energy innovations that target supply and demand at their core. This restriction impedes strong inter-

ventions in the supply or demand side of energy innovations but at the same time presents an opportunity for energy innovations such as in energy storage.

Capital investments and long turnover times

Many changes to energy supply and end-use systems require high capital investments with long turnover times (Schleich, 2009). These create large hurdles for rapid change as long payback times increase the risk and subsequently the cost of capital and at the same time create technological lock-ins as renewing investment only follows after decades (Holdren, 2006; Schleich, 2009; Unruh, 2000). Studies that estimate the costs to change even parts of a countries' energy infrastructures typically move into the trillion dollar range (Fraunhofer, 2015; Holdren, 2006; Rhodes, 2017) and this immense capital investment turns over with a characteristic time of 20-40 years (Schleich, 2009). Studies in other sectors find that these long investment horizons close the access to specific capital forms such as venture capital and hinders innovation (Herzlinger, 2006). Besides the need for immense capital as a restriction, the long time horizon of these investments pose limitations to the speed of technology switching (Kramer & Haigh, 2009).

However, signs of massive change are on the horizon. According to the World Energy Outlook 2018 of the International Energy Agency (IEA, 2018) the electrical power sector now attracts more investment than oil and gas combined and presents a major change for the energy sector, which was traditionally dominated by upstream spending on oil and gas. However, as a caveat, 95% of these investments were made in regulated markets or market segments where revenue risks are minimized (IEA, 2018) and overcapacities following overinvestments lower profitability.

The missing silver bullet

The transformation of the energy system cannot be solved with a single silver bullet (Holdren, 2006). None of the known energy sources is free of limitations, liabilities, or uncertainties, which makes investments and innovations and their outcomes and effects highly uncertain.

There is no energy technology with only negligible negative externalities. Apart from externalities that affect the social acceptance of new energy technologies (Wüstenhagen, Wolsink, & Bürer, 2007), general environmental impacts are subject to public scrutiny and debate. Wind farms are found to increase surface temperature (L. M. Miller & Keith, 2018; L. Zhou et al., 2012) and their bird and bat interactions have been subject to frequent studies (Powlesland, 2009; S. Wang & Wang, 2015). In the same vein,

energy from photovoltaic cells and their environmental impacts have been studied and a majority of positive effects were found compared to conventional energy sources, however the effects were not exclusively positive (Tsoutsos, Frantzeskaki, & Gekas, 2005; Turney & Fthenakis, 2011). The same applies for the related topic of sustainable transportation. The most recent generation of electric vehicles (EV) with lithium-ion batteries as energy carriers do not come without criticism; for example, the comparably high need for copper and aluminum brings an additional environmental burden (Notter et al., 2010). To summarize, there is no single system that solves all energy-related problems without considerable externalities, and consequently, the best system seems to be one that comprises a wide variety of energy sources, energy storages, and efficient energy usage regimes—leading to high planning, executing, and operating complexity.

1.1.4. ENERGY SECTOR AND VALUE CO-CREATION THEORY

The above discussed change drivers bring about new forms of interaction, new (value) offerings, new organizational forms, and change the roles of their actors—and in their combination alter the mechanisms of value co-creation. Domain-specific studies illustrate the importance of all these changes and the relevance for the electrical power sector (see Table 1-1) and motivate to study the effects in this very setting. On the other hand, these phenomenological changes correspond strongly with conceptual constructs of value co-creation mechanism (see Table 1-1 and Chapter 1.2). Hence, studying the altering mechanisms of value co-creation in the electrical power sector provides a rich empirical setting and at the same time by understanding them, it can help to overcome management challenges in the transformation of the sector.

Direct outcomes of change drivers	**Examples of studies in the electrical power sector**	**Corresponding value co-creation mechanism** (see Chapter 1.2)
New forms of interaction	• **Peer-to-Peer** (Mengelkamp et al., 2018; Morstyn, Farrell, Darby, & McCulloch, 2018; Schleicher-Tappeser, 2012) • **Multi-sided markets** (Evans & Gawer, 2016; Green & Newman, 2017; Schleicher-Tappeser, 2012; Van Alstyne et al., 2016; K. Zhou et al., 2016) • **Distributed techno-economic decision making** (Muhanji et al., 2018)	• **Interaction**

New offerings	• **New products** (Batley, Colbourne, Fleming, & Urwin, 2001; Ozaki, 2011; Saunders, Gross, & Wade, 2012) • **Servitization** (Bertoldi et al., 2006; Hannon, Foxon, & Gale, 2015a; Helms, 2016; Marino et al., 2011; Suhonen & Okkonen, 2013) • **New markets** (Bryant et al., 2018; Lehr, 2013; Shomali & Pinkse, 2016) • **New business models** (Loock, 2012; Nair & Paulose, 2014; Richter, 2012, 2013; Shomali & Pinkse, 2016; Strupeit & Palm, 2016; Suhonen & Okkonen, 2013)	• **Innovation**
New organizational forms	• **Platforms** (Giordano & Fulli, 2012; Morstyn et al., 2018; Weiller & Pollitt, 2016; K. Zhou, Fu, et al., 2016) • **Cooperatives and Communities** (Bauwens, Gotchev, & Holstenkamp, 2016; Walker et al., 2007; Yildiz, 2014) • **Virtual Power Plants and virtual utilities** (Othman, Hegazy, & Abdelaziz, 2015; Morstyn et al., 2018; Nosratabadi, Hooshmand, & Gholipour, 2017)	• **Coordination and alignment**
New actor roles	• **Active and passive prosumers** (Bryant et al., 2018; Erlinghagen & Markard, 2012a; Kubli, Loock, & Wüstenhagen, 2018) • **Off-grid or energy autarky** (Brosig & Waffenschmidt, 2016; Gude, 2015; Linssen, Stenzel, & Fleer, 2017)	• **Interaction** • **Coordination and alignment**

Table 1-1 Direct outcomes of change drivers

1.2. OVERVIEW ON RESEARCH ON VALUE CO-CREATION MECHANISMS

Superior value creation and appropriation is central to successful firms (Adner & Kapoor, 2010; Tantalo & Priem, 2016) and has been identified as the core of strategic management research (Foss & Lindenberg, 2013). As Porter (1985) and Adner & Kapoor (2010) put it: A firm's competitive advantage depends on its ability to create more value than its rivals, which, in turn, depends on the firm's ability to innovate successfully. However, despite the unequivocal consensus among scholars that understanding value creation is essential to explain firm success and competitive advantage (Lepak, Smith, & Taylor, 2007), relatively little is known about it (Tantalo & Priem, 2016). Scholars have observed that the plurality of both the targets and sources of value creation at multiple levels of analysis make it difficult to study and specific insights remain scarce (Lepak et al., 2007; Othman & Sheehan, 2011). Traditionally, value creation has been attributed to the value chain and value networks (Stabell & Fjeldstad, 1998) as well as invention and innovation (Lepak et al., 2007). This has been recently extended to view value creation mechanisms in conjunction with value capture mechanisms in a comprehensive model (Demil, Lecocq, Ricart, & Zott, 2015; Massa, Tucci, & Afuah, 2017; Teece, 2010; Zott, Amit, & Massa, 2011). Further, the business model introduced the notion of joint value creation as mechanism for value creation (Chesbrough, 2006; Zott et al., 2011).

Despite this growing understanding of value creation mechanisms, the profound ramifications of digitalization and subsequently many new forms of interactions and new offerings, increasing fluidity of actor's roles, and expanding macro focus of value creation are reason to question the current understanding of the content, processes, and mechanisms of value creation (Adner & Kapoor, 2010; Amit & Han, 2017; Priem, 2007; Vargo & Lusch, 2016). Digitalization has reshaped the ways firms do business and create value (Weill & Woerner, 2013). It has enabled new ways to orchestrate and connect resources as basis for value creation (Amit & Han, 2017), i.e., through platforms and ecosystems, and thus has powered many of the world's most profitable enterprises (Altman & Tushman, 2017). "The rise in coordination possibilities, enabled by the rapid progress of information and communication technologies, has spurred conceptualizations" of strategy in the context of interdependent value creation (Adner, 2017, p.50). Overall, it shifts the locus of value creation and thereby challenges some of the core axioms of strategic management (Benner & Tushman, 2015).

Further, this interdependence of value creation is frequently linked to a macro-view of value creation where a network or ecosystem is required to create superior value. For example, Lusch et al. (2010) point out that no one single organization owns the

knowledge, expertise, resources or capabilities to develop solutions alone in today's complex world. Today, this more relational, collaborative and networked nature of value creation is widely recognized (Adner & Kapoor, 2010; Chesbrough, 2006; Kindström, Kowalkowski, & Sandberg, 2013; Rusanen, Halinen, & Jaakkola, 2014) and puts special emphasis on actors' challenges that need to be overcome to create value, before bargaining over value capture (Adner & Kapoor, 2010).

This macro-view on innovation accompanied with digitalization accounts for a shift of *who* is seen as an actor in the creation of value. The distinction between producer, consumer, supplier, partner, etc. become fluid and blurred. In many industries, resources are widely distributed, and firms are required to form interorganizational ties to access the resources they need for innovation (Ahuja, 2000; Powell, Koput, & Smith-Doerr, 1996; Sytch & Tatarynowicz, 2014). These relationships frequently go as granular as the individual level. Additionally, digitization has increased the importance of customers as both the locus of value creation and as an essential resource provider (Amit & Han, 2017). Digitalization has expanded a firm's reach and access to external resources and enhanced the power at which "resources are exchanged, combined, and integrated." (Amit & Han, 2017, p. 1). These developments have laid the foundation for the rise of the "born-on-the-cloud" innovators (e.g., Uber, Airbnb) (Amit & Han, 2017, p. 1) and the sharing economy where customers can play multiple roles at the same time or switch roles (Amit & Han, 2017; Belk, 2014; Kathan, Matzler, & Veider, 2016; Weber, 2016).

Not surprisingly, the phenomenon of co-created value is subject to several adjacent research fields and has yet to converge into a comprehensive research agenda. Thus, discussions and research progress remain somewhat disconnected from each other, however with similar recurring themes. In the strategic management and technology and innovation field the research on demand-side strategy (Priem, Li, & Carr, 2012; Priem, Wenzel, & Koch, 2017), shares of business model research (Demil et al., 2015; Fjeldstad & Snow, 2017; Hienerth, Keinz, & Lettl, 2011; Snow, Fjeldstad, Lettl, & Miles, 2011), ecosystems (Adner, 2017; Adner & Kapoor, 2016; Kapoor & Lee, 2013; Moore, 1993), and platforms (Evans & Gawer, 2016; Parker, Van Alstyne, & Choudary, 2016) focus on the phenomenon of value co-creation. In the marketing field, a prosperous research community has evolved around the service-dominant logic that puts value co-creation as core axiom (Lusch, Vargo, & Gustafsson, 2016; Lusch, Vargo, & Wessels, 2008; Ramaswamy, Prahalad, & Ramaswamy, 2004; Vargo & Lusch, 2004). Further, the service-dominant logic and value co-creation was also adopted as a prominent topic within information systems research (Akaka & Vargo, 2014; Lusch & Nambisan, 2015; Nambisan, Lyytinen, Majchrzak, & Song, 2017; Yoo, Henfridsson, & Lyytinen, 2010).

Despite the scholarly plurality, researchers find the same recurring mechanisms for value co-creation: **interaction** between actors and organizations and the subsequent need for **alignment and coordination** thereof, the changing perspective on **resources,** and **innovation.** Moreover, studies frequently point to the contextual nature of value co-creation. At the same time, sector-specific studies showcase the focus on these problems and highlight their relevance (see Table 1-1).

In the following section, I will outline the state of research in each of the theoretical lenses and present corresponding research gaps that motivate this thesis.

1.2.1. GENERAL STRATEGIC MANAGEMENT AND DEMAND-SIDE MANAGEMENT

The scholarly consideration of value co-creation in strategic management dates to the early 2000s, but it did not receive much attention until a recent, exponential growth in the literature (Ramaswamy & Ozcan, 2018). As early as in 1999, Ramírez advocated value coproduction as increasingly important to strategic management and argued that firms can "create value; or more exactly, co-create and even co-invent it both with their suppliers and their own customers" (Ramírez, 1999, p. 51). Very specifically, and in the same year as Vargo and Lusch's seminal article on value co-creation and the service-dominant logic, Prahalad and Ramaswamy claimed that the nature of customer-company interaction is changing and customers "want to interact with the firms and thereby 'co-create' value" (Prahalad & Ramaswamy, 2013, p.6). In their paper, they built a first model of value co-creation that proposed dialogue, transparency, access, and risk-benefits as building blocks of value co-creation (Ramaswamy et al., 2004). In a summary of the strategy management literature Ramaswamy and Ozcan recently proposed value co-creation conceptualization as an "enactment of creation through interaction" (2018, p. 196) across systems-environments mediated by structuring organizations. With this conceptualization, they especially highlight interaction and the necessary alignment (through structuring organizations) as mechanisms of value co-creation and emphasize that the starting point for studying these new mechanisms is not the activities of firms but the relationships between actors that are the center for value creation (Ramaswamy & Ozcan, 2018). Next to interactions, reconfigurations of the value creational system in terms of resources and actor constellations is found to be central to new mechanisms of value creation (Basole & Rouse, 2008; Normann & Ramirez, 1998; Ramirez, 1999; Storbacka & Nenonen, 2011).

Next to this, the mechanisms of co-created value were integrated into the work of demand-side strategy scholars, which, in general, highlight the central role of value crea-

tion for firm success and notably point out that value must be first created before it can be captured (in contrast to the value capture focus of traditional strategy research) (Priem, 2007; Priem & Butler, 2001). In this regard, demand-side strategy research calls to broaden the boundaries of strategy research and calls for a shift of focus down to customer markets instead of the traditional view of strategic management of facing upward in the value chain to factor markets (Priem, Butler, & Li, 2013; Priem et al., 2012). Instead of the idiosyncratic focus on resources (Barney, 1991) and capabilities (Teece & Pisano, 1994; Teece, Pisano, & Shuen, 1997), a shift in strategy research is suggested to include the customer into the equation. Therefore, the central role of the customers and their heterogenous needs are especially highlighted in this research and thus breaks with the resource-based view, where possession and access to resources determines a firm's success and the firm is seen as a bundle of resources (Barney, Ketchen, & Wright, 2011). Contrary to the resource-based view of the firm, it is found that firms can gain competitive advantage even without having superior resources (e.g., Adner & Snow, 2010; Ye, Priem, & Alshwer, 2012). By putting the customer centerstage, this part of strategy research acknowledges that value is not simply out there but must be created. It thus reveals a current relative blind spot and makes the process of value creation subject to conceptual and empirical inquiries in strategic management research (Priem et al., 2017; Tantalo & Priem, 2016). The perspective is expected to advance the robustness of strategic management as it aims to solve the tautological issue that, in the resource-based view and capabilities perspective, value is determined to be exogenous to firms' resources (Kraaijenbrink, Spender, & Groen, 2010; Lockett, Thompson, & Morgenstern, 2009). In general, by looking both upstream and downstream to "simultaneously identify resource combinations that satisfy current customer needs" (Priem, Butler & Li, 2013, p. 473), value creation ultimately moves to systems where "the success of a value proposition depends on creating an alignment of partners who must work together in order to transform a winning idea to a market success" (Adner, 2012, p.4). In sum, the research on value co-creation and demand-side strategy especially highlight interactions and resource combination, or resource constellation, as means to value co-creation.

Current gaps in this literature regarding value co-creation mechanisms:

This literature especially highlights gaps in context factors that affect the sustainability (regarding competitive advantage) of co-creation-based value creation (Ramírez, 1999; Ye et al., 2012), asks how firms should obtain and manage co-creation-based innovations (Priem et al., 2012), and, more specifically, regarding this *'how question'* of which strategic processes and practices are most useful in developing effective value propositions? (Priem et al., 2017), as well as the question of how open this strategic process should be

(e.g., as part of a firm's open strategy-making process) (Gegenhuber & Dobusch, 2016; Hautz et al., 2017). Ozcan and Ramaswamy call to separate the *means* and *ends* of value co-creation to get a comprehensive understanding of value co-creation where the means represent the mechanisms of value co-creation (2018, p. 202).

1.2.2. BUSINESS MODELS

Scholars especially argue that the research on business models can support the understanding of organization and management of value co-creation (Frankenberger, Weiblen, & Gassmann, 2013; Frow, Nenonen, Payne, & Storbacka, 2015). Business models represent a broader conceptualization of value creation than the single firm and captures the shift toward networked value creation (Zott & Amit, 2008). Specifically, open business models (Chesbrough, 2012) describe value creation and its capture by "systematically collaborating with outside partners" (Osterwalder & Pigneur, 2010, p. 109). The networked nature of the business model frames it as a central concept in explaining how value is co-created (Storbacka, Frow, Nenonen, & Payne, 2012) as the transition from linear value chain thinking toward collaborative "value network thinking renders firm boundaries increasingly permeable, fuzzy, and fleeting" (Storbacka, Frow & Payne, 2012, p. 52). Researchers argue that the network-centric approach to business models opens up opportunities for framing new business logics completely based on value co-creation in existing and traditional businesses (Spieth & Schneider, 2013) and can thus organize value co-creation (Frow et al., 2015). First, the focal actor's business model sets the limits of value co-creation within a network (Storbacka et al., 2012) and thus a focal actor aiming to engage in value co-creation needs to create an open business model that allows other actors to influence distinct elements in a way that other actors have the opportunity to participate in these activities (Frankenberger et al., 2013; Storbacka et al., 2012). Second, the business model defines the availability and location of resources in the network and the activities of actor interaction in order to create value (Storbacka et al., 2012). Thus, it stresses the role of the business model as fundamental to shape a collaborative locus for integrating resources and improving value co-creation (Storbacka et al., 2012). In sum, the business model becomes central in explaining how value is co-created. Indeed, some authors (Frow et al., 2015; Priem et al., 2017; Storbacka et al., 2012) have clearly pointed out the strong link between business model design and a firm's ability to manage co-creation opportunities. To "support co-creation, the business model has to ensure change in the focal actor's practices, which is necessary for aligning the other actors' practices and for involving them in specific activities" Carida, Melia & Colucio, 2017, p. 343). "Co-creation changes the locus of value creation from inside the

company to collaborative interactions that lie beyond the firm boundaries" (Frow et al., 2015, p.466), firms need to "identify the practices that assist a firm in coordinating interactions that lead to an increase in resource density across multiple actors" (Frow et al. 2015, p. 466). Although helpful in identifying the coordinating role of business models, previous discussions do not sufficiently address business models for purposeful co-creation design (Frow et al., 2015).

Additionally, scholars argue that the management of co-creative business models requires both new mental models and tools. "The realization of the fact that value creation occurs in networks of interdependent actors pinpoints the need for increased transparency both between functional silos and between specific actors" (Storbacka et al., 2012, p.52).

In sum, the research on business models highlights the orchestration of resources and the alignment of actors as mechanisms of value co-creation, as well as the innovation of the business model itself as value co-creation mechanism.

Current gaps in this literature regarding value co-creation mechanisms:

The business model literature stream especially asks for additional research into the business model design elements of value co-creation (Hsu, 2015; West & Bogers, 2014; Wirtz, Pistoia, Ullrich, & Göttel, 2015), and puts forth two essential how-questions: how companies can purposefully identify co-creation opportunities (Frow et al., 2015; Priem et al., 2017; West & Bogers, 2014) and, more fundamentally, how value co-creation practices within business models create value (Caridà, Melia, & Colurcio, 2017; Wirtz et al., 2015).

1.2.3. ECOSYSTEMS

Value co-creation mechanisms are a central theme in the research on ecosystems, as a core aspect of an ecosystem is that scholars advocate "participating actors in the system have a joint value creation effort as a general goal" (Adner, 2017, p.43), or "ecosystems are groups of firms that must deal with either unique or supermodular complementarities that are nongeneric, requiring the creation of a specific structure of relationships and alignment to create value" (Jacobides et al., 2018, p. 2263). Actors in an ecosystem interdependently create a single value proposition (Adner, 2017). The literature on ecosystems finds that value is co-created in an ecosystem through new interactions and combinations (Adner, 2017; Cennamo, Ozalp, & Kretschmer, 2018) and subsequently the alignment of positions and activity flows among partners (Adner, 2017). Further, identifying and integrating modular complementors is another process that enables co-created value in an ecosystem (Eisenmann, Parker, & Alstyne, 2006; Jacobides et al., 2018; Teece, 2007). A

link to the classical conceptualization of value creation is the emphasis on overcoming innovation challenges to create value. However, in an ecosystem, innovation is interdependent among actors (Adner, 2006) and the success of an internal innovation is dependent on the success of innovations in the external environment (Adner & Kapoor, 2010; Iansiti & Levien, 2004; Jacobides et al., 2018). This points to overcoming ecosystems' innovation challenges as a mechanism for value co-creation (Adner & Kapoor, 2010, 2016; Helfat & Raubitschek, 2018). In return, the consideration of ecosystem dynamics thus becomes critical for crafting and understanding strategy (Adner, 2017). Regarding value capture mechanisms, Adner (2017) refers to positioning within ecosystems as a central element and Adner and Kapoor (2016) highlight the concept of bottlenecks as pivotal to explain value capture.

In sum, this literature especially focuses on interaction and alignment as mechanism of value co-creation.

Current gaps in this literature regarding value co-creation mechanisms:

Kapoor and Lee argue there is an initial conceptualization and understanding of value co-creation mechanisms, however, '**How** does the design of the ecosystem including actors and **interactions** rather than its existence per se shape firms' value creation and appropriation' (Kapoor & Lee, 2013) remains an essential gap in the literature. Furthermore, the literature asks how the roles of actors in creating **context** affect the core mechanism of value co-creation in ecosystems (e.g., Kahl, King, & Liegel, 2016).

1.2.4. SERVICE-DOMINANT LOGIC

Value co-creation is a constituent element of the service dominant logic (Galvagno, Dalli, & Galvagno, 2014) and as such Vargo and Lusch put it centerstage, "The service-dominant logic first emerged in the marketing literature as a service-centered logic representing an alternative understanding of exchange and value creation, driven by a departure from traditional goods-dominant logic (GDL) views". (Wilden, Akaka, Karpen, & Hohberger, 2017, p. 2). In short, the fundamental premises of the service-dominant logic suggest that market actors interact with each other to integrate resources and co-create value via direct and indirect service provisions (Vargo & Lusch, 2008). Essential to the 2008 revision of the service-dominant logic has been the introduction of resource integration as the central mechanism of co-created value and the drawing of attention toward value being an idiosyncratic phenomenon (Wilden et al., 2017). The key to value co-creation is identified to be "the ongoing interplay of resource creation and application afforded through reciprocal exchange and differential access and integration" (Vargo & Lusch, 2017, p. 47). Mechanisms for value co-creation through resources are identified to

be "cooperative and collaborative processes between actors, leading to experiential outcomes and outputs" (Edvardsson, Kleinaltenkamp, Tronvoll, McHugh, & Windahl, 2014, p. 297), requiring process(es) and forms of collaboration (Kleinaltenkamp et al., 2012), done through activities and interactions in the customer's service network (McColl-Kennedy, Vargo, Dagger, Sweeney, & Kasteren, 2012), that are contingent to the type of resources (Jaakkola & Hakanen, 2013; Paredes, Barrutia, & Echebarria, 2014) and the knowledge of the resources available to each actor involved (Paredes et al., 2014). It can happen both as a process of emergence and as a process of interaction (Peters et al., 2014), and it makes use of methods and practices for integrating resources (Skålén, Gummerus, Koskull, & Magnusson, 2015) through an orchestrator role of the firm (Gidhagen, Ridell, & Sörhammar, 2011) and value creation through service innovation is considered as the rebundling of diverse resources that creates novel resources that are beneficial to some actors in a given context (Lusch & Nambisan, 2015). In this view, the integration of resources is central to the generation of new resources (Akaka, Vargo, & Wieland, 2017). Additionally, the contextual and phenomenological nature of value is highlighted and the experience and the evaluation of the resource integration becomes a central factor (Akaka et al., 2017). Regardless of the centrality and repeated importance of the need for understanding resource integration as the core mechanism of value co-creation within the service-dominant logic, the practices and methods for the resource integration remain fuzzy (Kleinaltenkamp et al., 2012, p. 59). In general Kleinaltenkamp et al. point out that "there is much to learn about the practices of integrating resources and how to design and configure the integration process" (Kleinaltenkamp et al., 2012, p. 203).

In sum, this literature focuses on resources and their corresponding integration as core mechanisms to co-create value. Despite this focus on resources, the interactive nature of value co-created guided through alignment mechanisms is equally important.

Current gaps in this literature regarding value co-creation mechanisms:

Despite the existing and growing research within the service-dominant logic on the central value co-creation mechanism of resource integration, some essential gaps still remain. Further research is needed on the process of value co-creation (Payne et al., 2008; Vargo et al., 2008; Moeller et al., 2013), particularly on understanding of resource integration between "complementary and competing actors" including the "interaction and integration of resources" (Spohrer, Vargo, Caswell, & Maglio, 2008) and empirically studying the way resources are integrated (Colurcio, Caridà, & Edvardsson, 2017). Scholars call for research on resource integration in the context of value co-creation in networks (Beirão, Patrício, & Fisk, 2017; McColl-Kennedy et al., 2012; Ostrom,

Parasuraman, Bowen, Patrício, & Voss, 2015) and how actor activities for resource integration are coordinated and adapted to each other (Beirão et al., 2017; McColl-Kennedy et al., 2012). Overall, Kleinaltenkamp et al. find that the practices of integrating resources and the resource integration process for value co-creation "remain fuzzy" (2012, p. 59)

1.2.5. PLATFORMS AND MULTI-SIDED MARKETS

Literature on platforms and multi-sided markets is mainly driven by two perspectives: the industrial economics perspective, which focuses on how platforms create "value by coordinating transactions between two or more groups of consumers who would not have been able to connect without the platform" (Smorodinskaya, Russell, Katukov, & Still, 2017, p. 5249), and the technology and innovation management perspective, which sees platforms as mechanisms that provide a technological interface between two sides thus helping firms to achieve economy of scope effects and facilitate innovation (Gawer, 2014). Hence, value in platforms is co-created and co-delivered by multiple contributing entities (de Reuver, Sørensen, & Basole, 2017) Both sides agree that value in two-sided markets and platforms is co-created through matching two distinct groups (Altman & Tushman, 2017; de Reuver et al., 2017; Eisenmann et al., 2006; D. S. Evans, 2003) and facilitating transactions among the users (Cennamo & Santalo, 2013; Eisenmann et al., 2006; Evans & Gawer, 2016; Kapoor & Lee, 2013; Rochet & Tirole, 2003). The value from these interactions is directly or indirectly dependent on network effects (Eisenmann et al., 2006, 2011). Additionally, new forms of innovations are enabled by platforms. The main focus is the co-creation of innovation through complementors (Gawer & Cusumano, 2014; McIntyre & Srinivasan, 2017; Ranjan & Read, 2016; Smorodinskaya et al., 2017). This complementary innovation leverages resources located outside the firm, ranging from customers, research companies, and business partners to universities (Ceccagnoli & Forman, 2012). Consequently, a platform strengthens firms' ability to stimulate value co-creation with their networks of complementors (Adner & Kapoor, 2010). On platforms this happens through the openness of the platform and "by breaking up a complex system into discrete components that interact through standardized interfaces" (Gawer, 2014, p.421). Thus, platforms provide value via a common architecture, defined interfaces, complementary set of modules, and the governance of interactions among these components (McIntyre & Srinivasan, 2017). Especially in digital platforms, this creates new and flexible means for inter-organizational relations and facilitates highly distributed and automated coordination of distributed resources (de Reuver et al., 2017). Platforms also co-create value by avoiding investments in hard-to-duplicate complementary assets (Ceccagnoli & Forman, 2012).

In sum, this literature especially focuses on new mechanisms of alignment and resource combination that create new opportunities to co-create value.

Current gaps in this literature regarding value co-creation mechanisms:

Given the overarching consensus on the mechanisms of value co-creation in platforms and multi-sided markets, it is surprising that questions of how to manage and govern these are still in their relative infancy. Notably, the questions of how to govern platform interaction and participation (Ceccagnoli & Forman, 2012; de Reuver et al., 2017; McIntyre & Srinivasan, 2017) and how to manage heterogenous complementors, their resources and dynamics over time (de Reuver et al., 2017; Eaton et al., 2015; Kapoor & Lee, 2013; McIntyre & Srinivasan, 2017; Yoo et al., 2010) and through technological changes (McIntyre & Srinivasan, 2017) remain.

1.2.6. INNOVATION

The rise of value creation mechanisms based on value co-creation also challenges the explanatory power of extant innovation theory (Barrett, Davidson, Prabhu, & Vargo, 2015; Benner & Tushman, 2015; Goldfarb & Tucker, 2012; Greenstein, Lerner, & Stern, 2013; Yoo et al., 2010). This is especially relevant as innovation has been identified as a value creation mechanism in several theoretical lenses.

Traditionally, innovation management has focused on internal linear processes and relatively confined outcomes of innovation such as products, processes, or services (Nambisan et al., 2017). "For much of the 20th century, the practice of technological innovation was ascribed to a corporate research and development (R&D) departments embedded in a vertically integrated commercialization infrastructure (Chandler, 1977; Freeman, 1989)." (West & Bogers, 2014, p.814). Traditionally,

"innovation literature has focused on firm-centric, product-development processes, as well as dyadic interactions through which value flows sequentially from innovation-creating firms to innovation-adopting customers. In this view, innovation is largely driven by firm activities and results in the development of new products and/or processes." (Akaka, Vargo & Wieland, 2017, p.2).

Similar ramifications, which lead to the increasing importance of value creation as a joint process, also impact innovation management. For example, as Coombs and Miles (2000) put it:

> "We are moving away from a model of innovation that puts all the emphasis on artifacts and technological innovation; and toward a model which sees innovation in terms of changes in market relationships but with major artifact and technological dimensions." *(p. 100)*

Extant literature finds that the practices of innovation and innovation management are changing in three main, broad categories: the increasing external focus and boundary-spanning nature of innovation, complexity through non-ceteris-paribus innovation, and the increasingly interactive nature of innovation.

Increasing external focus and boundary spanning innovation

The locus of innovation is increasingly moving from the firm level to the network level (Schilling & Phelps, 2007). No longer are inventions and innovations (and even the ideas from which they rise) developed from within the boundaries of an organization. Instead, they emerge from the common action of a network of actors ranging from suppliers and the partner network to customers and independent inventors, constituting in a network focus of innovation (Chesbrough, 2003; Lusch & Nambisan, 2015; Nambisan & Sawhney, 2007; Lusch et al., 2012). From the 2000s onwards, innovation management saw an explosion of collaborative and boundary-spanning activities (Altman & Tushman, 2017) and broader, multi-partner ecosystems, which scholarship is only beginning to explore (Adner & Kapoor, 2010; Bresnahan, Davis, & Yin, 2014; West & Wood, 2013). This increasing external focus leads to a transition that moves organizations from thinking primarily about internal resources to resources outside of the company (Altman & Tushman, 2017). This transition is of particular interest in the context of innovation as innovation is often the result of recombining existing resources (Arthur, 2009; Lusch & Nambisan, 2015; Schumpeter, 1934). The external focus on resources for innovation has already been highlighted in the literature on open innovation (e.g., Chesbrough, 2006), user innovation (Bogers, Afuah, & Bastian, 2010; von Hippel, 2005), business model innovation (Chesbrough, 2006; Frankenberger et al., 2013; Wirtz et al., 2015), and recently in the literature on platforms and ecosystems (Altman & Tushman, 2017; Kapoor & Lee, 2013; McIntyre & Srinivasan, 2017). These tactics extract benefits from users, ecosystem partners, and others that create ideas, select ideas, innovate, produce, co-create, and in general execute roles externally that formerly have been performed by core firm functions (Altman & Tushman, 2017; Beirão et al., 2017; Vargo, Maglio, Archpru, Akaka, & Archpru, 2008; von Hippel, 2007). Consequently, a large number of innovations that are introduced to the market today are not introduced by one firm alone, but by a set of partners that have agreed to join forces (Rehm et al., 2016), which is found to be especially suitable for small and medium-sized enterprises (SMEs) (Chesbrough, 2003; Rehm et al., 2016). This external focus of innovation and the locus of innovation moving outside of the organization (Lakhani, Lifshitz - Assaf, & Tushman, 2012) alters the challenges of innovation from internal to external, as the success of innovations becomes dependent on the success of complementary innovations (Adner & Kapoor, 2016) and in-

novation processes and selection move beyond the firm boundaries (Altman & Tushman, 2017). Moreover, the systems perspective removes the distinction of "producers" and "consumers" as well as the notion of "innovators" and "adopters" (Akaka et al., 2017; Koskela-Huotari, Edvardsson, Jonas, Sörhammar, & Witell, 2016; Reypens, Lievens, & Blazevic, 2014). Akaka et al. point out, that in this view that "innovation can be broadly conceptualized as the co-creation or collaborative recombination of practices that provide novel solutions for new or existing problems" (2017, p. 54), and that the focus of innovation moves beyond developing new outputs exchanged in dyadic relationships (Michel, Brown, & Gallan, 2008) to activities targeted at altering the value co-creation practices among many actors (Vargo, Wieland, & Akaka, 2015). Hence, innovation is seen as "breaking, making, and maintaining institutionalized rules of resource integration" (Koskela-Huotari et al., 2016, p. 2996).

Interdependence: Non-ceteris-paribus and non-linear innovation

Contrary to long-standing wisdom of innovation management, recent developments in innovation management look at the simultaneous alternation of multiple factors, rather than on product, process, or service innovation individually. Beginning with the literature on business model innovation, which highlights the concurrent innovation of value creation and value capture, scholars especially find that innovation agency becomes more distributed (Lakhani & Panetta, 2007) and the innovation context is dynamic and often consists of a "unexpected collection of actors with diverse goals and motives" (West & Bogers, 2014). These collectives are dynamic as "actors […] can opt in and out while their goals change, new competencies are needed, motivations shift, complementary capabilities need to be garnered, new constraints and opportunities emerge, or varying contributions become recognized (Nambisan et al., 2016, p. 225). This is also reflected by recent changes on the work on innovation networks described as "loosely coupled systems of autonomous firms" (Dhanaraj, 2006, p. 659). In these systems, both the system itself and the novel outcome (product, service, process, value proposition) is subject to innovation.

Focus of innovation through enabling interactions

Recent research on networked and systemic forms of innovation has begun to widen the context of innovation. It goes beyond the individual firm activities and moves to the *interactions* and efforts of many (Adner & Kapoor, 2016; Akaka et al., 2017; Möller & Rajala, 2007; Nelson & Nelson, 2002; von Hippel, 2007). Already, innovation was conceptualized as a resource-based process that arises through business and social interaction (Chesbrough, 2006; Trott & Hartmann, 2009). In the context of value co-creation, the

focus of innovation shifts from the sole features (e.g. novel product features) of innovation output to experience that is co-created through the novel features with actors with the means of the novel value output (Ramaswamy et al., 2004; Vargo & Lusch, 2004, 2008). This is also reflected in the perspective of ecosystems that places special emphasis on the "rise of interdependence and the potential for symbiotic relationships in productive ecosystems. It focuses on questions of access and openness, highlighting measures such as number of partners, network density, and actors' centrality in larger networks" (Adner, 2017, p.50). Also the literature on platforms focuses on interfaces and how these should be designed (Gawer, 2014). Many of the most recent developments in innovation management such as platforms, open/user innovation, business models, and ecosystem strategies all include interactions between organizations and actors that are external to the organization as paramount to their success (Adner, 2017; Altman & Tushman, 2017; Boudreau & Jeppesen, 2015; Cennamo & Santalo, 2013). Research finds that this interaction sometimes is coordinated or orchestrated (Parker et al., 2016) while in cases with distributed structures this is not the case (Altman & Tushman, 2017; Kornberger, 2017). In ecosystems without an orchestrator, Altman and Tushman (2017) find that interactions can be direct and bidirectional or may be unidirectional and indirect. According to them how to manage multiple types of interactions with multiple actors "becomes integral to strategic success across the value chain" (Altman & Tushman, 2017, p.189), however this essential how question remains unanswered to date.

Current gaps in this literature regarding value co-creation mechanisms:

The central question in a value co-creation perspective on innovation is "How do innovations form/evolve?" (Nambisan et al., 2017). Thus, specific gaps that need to be addressed are studies that look at innovation beyond dyadic relationships (Davis, 2016), including **how** organizations can carefully orchestrate and organize the design of value co-creation (Frow et al., 2015; Nambisan et al., 2017; Reypens et al., 2014), how can resources be orchestrated such that every potential value-creating participant is both a potential locus of value creation as well as a resource provider to innovate value co-creation (Amit & Han, 2017; Baker & Nelson, 2005) and the question of how innovating actors align (Nambisan et al., 2017).

Theoretical lens	**Mechanisms of value co-creation**	**Focus**	**Gaps in literature regarding value co-creation mechanisms**
Strategic management's view on the value creation processes	• Innovation (Lepak et al., 2007) • Value Chain (Porter, 1985)		(-)
Business Models	• Design of a business model that enables interaction and resource density (Storbacka et al., 2012) • Value creation and value capture are conceptualized as interdependent and explained in a single model (Demil et al., 2015; Massa et al., 2017; Zott et al., 2011) • The business model itself is the subject of value creation and capture processes (Frow et al., 2015; Storbacka et al., 2012)	• Resource orchestration • Alignment • Innovation	• Business model design elements for value co-creation (Nenonen & Storbacka, 2010) • Identification of value co-creation opportunities in business models (Frow et al., 2015; Priem et al., 2017) • The mechanisms of business model related value co-creation (Caridà et al., 2017)
Ecosystems	• Interdependent innovation (Adner, 2006) • New interactions and combinations (Adner, 2017) • Alignment of positions and activity flows among partners (Adner, 2017) • Complementors (Eisenmann et al., 2006; Teece, 2007)	• Interactions and alignment • Innovation	• How does the design of the ecosystem rather than its existence per se shape firms' value creation and appropriation? (Kapoor & Lee, 2013) • How does the role of actors as context shapers influence value co-creation? (Kahl et al., 2016)
Service-dominant logic	• Integration of resources (Edvardsson et al., 2014; Vargo & Lusch, 2016) • Service innovation (Lusch & Nambisan, 2013, 2015; Rusanen et al., 2014)	• Resource orchestration • Innovation	• How does resource integration as central value creation mechanism work? ○ In networks of competing and complementary actors through interaction (Beirão et al., 2017; McColl-Kennedy et al., 2012; Ostrom et al., 2015; Spohrer et al., 2008) ○ Process of resource integration (Edvardsson et al.,

			2014; Kleinaltenkamp et al., 2012; Payne, Storbacka, & Frow, 2008) ○ Coordination and adaption between actors (McColl-Kennedy et al., 2012)
Demand-side strategy	• Demand-side synergies (Priem et al., 2017) • Recombining otherwise mundane resources (Priem et al., 2012) • Innovation (Priem et al., 2017)	• Resource orchestration • Interaction	• How should firms obtain and manage co-creation-based innovations? (Priem et al., 2017) • Openness of the strategic process to create value co-creation (Gegenhuber & Dobusch, 2016; Hautz et al., 2017)
Platforms	• Enabling transactions and interaction (de Reuver et al., 2017; Eisenmann et al., 2006; Evans & Gawer, 2016; Kapoor & Lee, 2013) • Direct and indirect network externalities (Eisenmann et al., 2006, 2011; Parker et al., 2016) • Complementary innovation (Gawer, 2014; McIntyre & Srinivasan, 2017; Smorodinskaya et al., 2017)	• Interactions & Alignment • Innovation	• How to govern platform interaction and participation? (Ceccagnoli & Forman, 2012; de Reuver et al., 2017; McIntyre & Srinivasan, 2017) • How to manage heterogenous complementors, their resources and dynamics over time? (de Reuver et al., 2017; Eaton et al., 2015; Kapoor & Lee, 2013; McIntyre & Srinivasan, 2017; Yoo et al., 2010) • Platforms as means and ends of value co-creation (Ramaswamy & Ozcan, 2018)
Innovation	• Collaborative recombination of resources (Akaka et al., 2017; Altman & Tushman, 2017; Lusch & Nambisan, 2015) • Distributed innovation agency and coordination (Lakhani & Panetta, 2007; Lusch & Nambisan, 2015; West & Bogers, 2014) • Interactions (Adner & Kapoor, 2016; Akaka et al., 2017; Altman & Tushman, 2017)	• Interactions & Alignment • Resource orchestration • Innovation	• How do innovations form and evolve? ○ In networks (Davis, 2016) ○ Through orchestration and design of novel value co-creation (Frow et al., 2015; Nambisan et al., 2017; Reypens et al., 2014) ○ Through resource orchestration and configuration (Amit & Han, 2017; Sirmon, Hitt, Ireland, & Gilbert, 2011) ○ Through the alignment of actors (Adner & Kapoor, 2016; Altman & Tushman, 2017; Nambisan et al., 2017)
General Strategic Management	• Interactions as locus of value creation and experiences as process of value co-creation (Prahalad & Ramaswamy, 2013)	• Interactions & Alignment	• How do context factors shape the sustainability of value co-creation? (Ramírez, 1999)

	• Enactment of interactional creation across interactive system-environments entailing agencing engagements and structuring organizations (Ramaswamy & Ozcan, 2018, p. 202) • Connecting new value creational opportunities with resources (Ramaswamy & Ozcan, 2018).	• Resource orchestration	• The dynamics of co-creation in an increasingly digitalized world of interactions (Ramaswamy & Ozcan, 2018)

Table 1-2 Overview of state of the art in the theories used

In sum, the last decade has originated digitally enabled companies such as UBER, Lyft, Airbnb, Alibaba, etc., which make use of customers as resources and change entire industries. The subsequent potential to rapidly create enormous value have astounded managers and researchers alike. In line with these changes, scholars observed that the underlying mechanisms of value creation are undergoing substantial alternations. Value creation becomes an increasingly collective, cooperative, interdependent, networked or conjoined endeavor (Adner, 2017; Adner & Kapoor, 2016; Lusch et al., 2010; Tatarynowicz & Sytch, 2010; Zott et al., 2011) and thus the term ***value co-creation*** has been coined (Amit & Han, 2017; Nenonen & Storbacka, 2009; Prahalad & Ramaswamy, 2013; Tantalo & Priem, 2016; Vargo & Lusch, 2004). The evolving mechanisms are still very poorly understood (e.g., Ramaswamy & Ozcan, 2018) and so far the knowledge about the mechanisms is dominantly of a conceptual nature (Amit & Han, 2017; Hansen, 2017; Vargo & Lusch, 2017). Theories covering value co-creation unanimously identify interaction and alignment, resource management, and innovation as imperative for value co-creation. However, how these mechanisms play out and how actors employ them to co-create value is under investigated. Given the current lack of knowledge about this emerging phenomenon, this thesis asks:

> *RQ: How do actors employ mechanisms of value co-creation to create superior value in networked industries?*

Consequently, because of the timeliness and nature of the phenomenon itself, this thesis draws on an exploratory research setting and employs case study methods to address the research question at hand. Deliberatively, this thesis does not engage in the ongoing discussion on the definition of value co-creation, but considers value co-creation from a phenomenological point of view that encompasses all specific theoretical and empirical occurrences in which companies and customers generate value through interaction (Vargo & Lusch, 2008), alignment (Adner, 2017), resource (integration) (Edvardsson et al., 2014), and orchestration (Amit & Han, 2017; Sirmon et al., 2011) in varying contexts (Nahi, 2016a). Specifically, this thesis focuses on value co-creation *mechanisms* as unit of analysis that refers to entities and activities and the constellation of entities and activities that are organized such that they regularly bring about a particular type of outcome (Machamer, Darden, & Craver, 2000). These activities bring about change, and the type of change brought about depends upon the properties and activities of the entities and the relations between them (Machamer et al., 2000).

Consequently, research gaps also form around these key themes. Given the relative infancy of value co-creation research, a considerable proportion of the previous work is conceptual and stresses the need for empirical research (Adner, 2017; Amit & Han, 2017;

McIntyre & Srinivasan, 2017; Ramaswamy & Ozcan, 2018; Vargo & Lusch, 2016). Each research discipline defines its own specificities and focus of attention, but they unite in the fact that they unanimously accentuate the **how** question of value co-creation mechanisms.

Summary of research gaps addressed by this thesis:

- Empirical multi-informant data to understand how firms capitalize on value co-creation mechanisms
- Alignment and coordination mechanisms for inter-organizational value creation
- Interaction of resources and interaction of organizations as mechanisms for resource integration
- Contextual variations in value co-creation mechanisms and processes

1.3. Goal of the Thesis and Research Questions

This dissertation aims to address the research gaps as described in the literature review and contributes to research on strategic management, innovation management, and energy innovation. Managing value co-creation (mechanisms) is of particular interest in networked industries.

Since the extant research falls short of providing insights on how exactly firms employ value co-creation mechanisms the main question behind my research is:

> *RQ: How do actors employ mechanisms of value co-creation to create superior value in networked industries?*

This overall question is divided into three sub-questions as shown in my research framework below. Each of those sub-questions targets a particular gap identified in the current literature on value co-creation mechanisms.

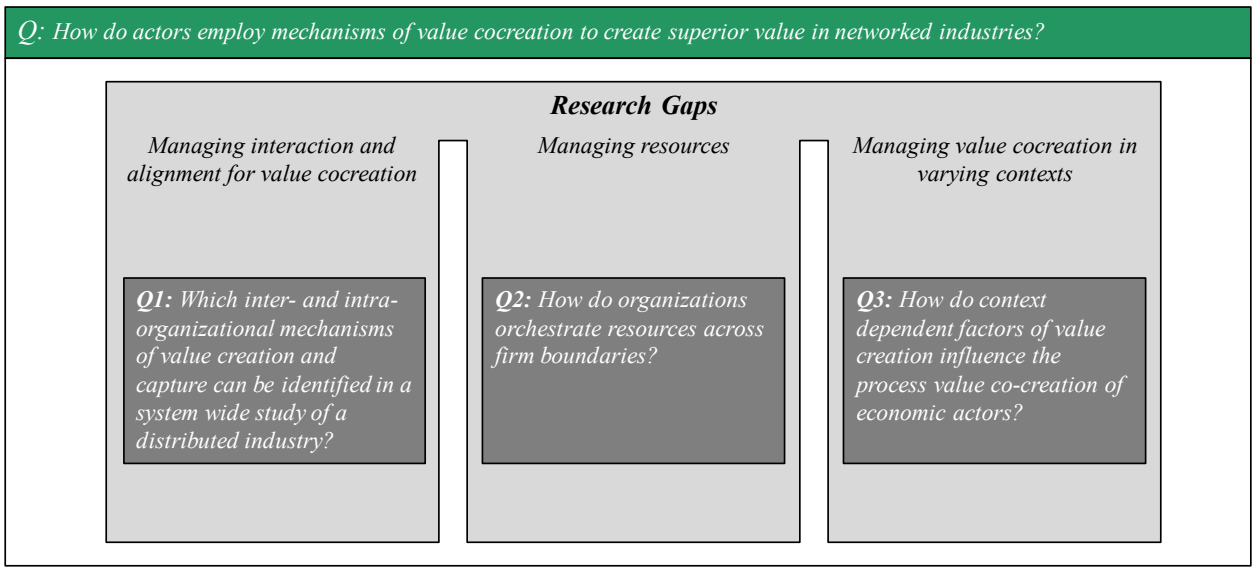

Figure 1-3 Overview of research

Following the finding that one central value co-creation mechanism is the alignment of internal and external activities, the first part takes an industry perspective to identify the executed inter- and intra-organizational activities that create and capture value. Correspondingly, the paper identifies business model archetypes in the electrical power sector and strategic dimensions that define value creation and capture and gives an industry-wide perspective of inter-organizational mechanisms to create and capture value.

> *RQ1a: Which inter- and intra-organizational mechanisms of value creation and capture can be identified in a system wide study of the electrical power sector as networked industry?*

The second part focuses on the management of resources as mechanism of value co-creation. This paper answers the essential question of *how* resource orchestration is managed in an increasingly networked industry to co-create value. Leveraging the empirical setting of Virtual Power Plants, this paper identifies the underlying mechanisms and practices of how resource orchestration and integration is applied to co-create value.

RQ1b: How do organizations orchestrate resources across firm boundaries?

The third part takes a polar empirical setting to single out the context factors that influence the mechanisms of value co-creation and its process. This addresses the calls to include the contextual nature of value itself as well as the mechanisms of value co-creation into the study of value co-creation mechanisms. Thus, part three aims to answer the following question:

RQ1c: How do context dependent factors of value creation influence the process value co-creation of economic actors?

2. METHODOLOGICAL APPROACH AND EMPIRICAL DATA IN THIS THESIS

2.1. METHODS

Overall, this thesis utilizes exploratory multiple case studies to account for the still phenomenological nature of value co-creation mechanisms and to answer the central questions of how these mechanisms work and how they are applied in inter-organizational settings (Eisenhardt, 1989; Yin, 2003). This overall research design was chosen because of a problematic existing theory, the complexity of processes under study and the fact that the thesis deals with hard to measure constructs (Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Gehman et al., 2018; Yin, 2009). First, as outlined in the overview of the state of research, the status of research on value co-creation is fragmented across many fields and is contradictory at points. Second, the nature of value co-creation is fundamentally complex. The typically high number of actors and the interdependence of constructs on multiple levels accounts for this complexity (Akaka, Vargo, & Lusch, 2013; Bendul, Rosca, & Pivovarova, 2017; Foss & Lindenberg, 2013; Galvagno et al., 2014; Lehrer, Ordanini, DeFillippi, & Miozzo, 2012; Polese, Mele, & Gummesson, 2017). In this thesis these are interdependencies within business models, across organizations and resources, and context factors. Finally, this thesis covers constructs such as business models, context-dependent processes, and the management of resource orchestration, which have all been identified as hard-to-measure constructs (Akaka et al., 2013; Amit & Han, 2017; Carnes, Chirico, Hitt, Huh, & Pisano, 2016; Foss & Saebi, 2017a; Massa et al., 2017; Teece & Linden, 2017; Van Alstyne & Parker, 2017) and thus are favorable to be studied with a qualitative case study method.

Each of the studies within this thesis uses variations of the multiple case study methodology, e.g., polar (Martin & Eisenhardt, 2010), within industry (Hallen & Eisenhardt, 2012; Ozcan & Eisenhardt, 2009), and across industry (Santos & Eisenhardt, 2009). In general, this thesis takes the multiple case study approach because the generated theory is more likely to be parsimonious, accurate, and generalizable (Gehman et al., 2018). As each chapter takes a slightly different methodological spin to the method of qualitative case studies, the specific methodological approach is specified for each study.

2.2. EMPIRICAL DATA

This thesis builds on a broad empirical base combining primary and secondary data sources to address the research questions detailed in Chapter 1.3. A combined overview is given in Table 2-1.

Description	**Data type**	**Data Sources**	**Quantities**	**Comments**	**Used in chapter**
Business Model Descriptions	Secondary	Thomas Reuters & public	150 business model instances (firms)	Data used for the 150 instances from U.K., U.S.A., and India.	3
Business Model Descriptions	Secondary	Crunchbase & public	130 business model instances (firms)	Data used for the 130 instances from U.K., U.S.A., and India.	3
Case A	Primary and secondary	Interviews & public	8	Market: Western	4+5
Case B	Primary and secondary	Interviews & public	3	Market: Western	4+5
Case C	Primary and secondary	Interviews & public	4	Market: Western	4+5
Case D	Primary and secondary	Interviews & public	6	Market: Western	4+5
Case E	Primary and secondary	Interviews & public	4	Market: Western	4+5
Case F	Primary and secondary	Interviews & public	2	Market: Western	4+5
Case G	Primary and secondary	Interviews & public	6	Market: Western	4+5
Case H	Primary and secondary	Interviews & public	4	Market: Western	4+5
			160 pages secondary data (see Chapter 4.4.1 for further details)		

Case I	Primary and secondary	Interviews & public	3	Market: Western	4+5
Case J (BOP_Case 1)	Primary	Interviews	4	Market: BoP	5
Case K (BOP_Case 2)	Primary	Interviews	5	Market: BoP	5
Case L (BOP_Case 3)	Primary	Interviews	3	Market: BoP	5
Case M (BOP_Case 4)	Primary	Interviews	4	Market: BoP	5
Case N (BOP_Case 5)	Primary	Interviews	1	Market: BoP	5
Case O (BOP_Case 6)	Primary	Interviews	1	Market: BoP	5

Table 2-1 Overview of empirical data used in the thesis

3. MANAGING INTERACTION AND ALIGNMENT FOR VALUE CO-CREATION[2]

3.1. ABSTRACT

As the electrical power sector is undergoing a fundamental transition, understanding the sector's competitive landscape becomes increasingly difficult. Thus, our study sets out to identify business models and their strategic dimensions in the sector to map this landscape. We analyze 280 firms (start-ups and mature) from three different countries (U.S.A., U.K., India) representing three different regulatory regimes. We find that the 280 firms adopt 25 distinct business model archetypes. These business models organize the sector into strategic groups that differ in their size, composition, and relevant strategic dimensions. We discuss the implications of these findings for managers and policymakers.

3.2. INTRODUCTION TO THE NEED FOR ARCHETYPES

Driven by changing consumer demands, demanding regulators, new entrants, and new technologies, the electrical power sector is currently undergoing a fundamental transition and is becoming increasingly competitive in many parts of the value chain (Prinz & Dudenhausen, 2012; Richter, 2013; Schleicher-Tappeser, 2012). These changes make it increasingly difficult for managers and policymakers in the sector to understand the competition adequately, which impedes their ability to make effective strategic decisions and plans (Anand, Joshi, & O'Leary-Kelly, 2012). Dividing the competitive landscape into archetypes can improve managers' and policymakers' understanding of the competition, support them in identifying relevant competitors and competitive behavior, and consequently, enhance the quality of their strategic decisions respective their regulation (Clark, 2011; Kaplan, 2011). As the segmentation of the industry into archetypes allows scholars, managers and policymakers alike to better understand the competition in an industry, it is not surprising that scholars have started to examine these divisions in the electrical power sector. Existing research has organized firms from the electrical power sector into strategic groups (Short, Ketchen, Palmer, & Hult, 2007) based on objective and traditionally quite stable criteria, such as their geographical location (Moutinho, Moreira, & Mota,

[2] This chapter is based on a research article:
Original Title: BUSINESS MODELS FOR THE ELECTRICAL POWER SECTOR: A STRATEGIC GROUP PERSPECTIVE ON THE U.K., U.S.A. AND INDIA
Coauthors: Maximilian Palmié, Jonas Kahlert & Oliver Gassmann
Status at submission: 3rd round Revise & Resubmit at Utilities Policy

2014), the firms' position in the energy value chain (Shukla & Thampy, 2011), or the market segments they serve (Swadley & Yücel, 2011).

While these criteria have proved very valuable for categorizing firms in the past and are still useful for many purposes today, they do not provide a comprehensive picture of competition in today's environment of increasingly liberalized markets, value chain reconfigurations, and new entrants from other sectors (Erlinghagen & Markard, 2012b). As such objective criteria become less determinative, our study supplements existing research on strategic groups with an examination of business models in the electrical power sector. A business model can be understood as a model adopted that explains how the focal firm creates and captures value for itself and its various stakeholders (Casadesus-Masanell & Ricart, 2010; Gavetti, Levinthal, & Rivkin, 2005; Martins, Rindova, & Greenbaum, 2015; Zott & Amit, 2010). During recent years, the business model concept has emerged as a primary mental model that managers in the electrical power sector adopt to think about their own firm as well as its competition (EY, 2015; Gaspari, Lorenzoni, Frías, & Reneses, 2017; KPMG, 2015). An analysis of existing business models may also help firms if they want to innovate their business model and increase their option space. Research in various industries suggests that business model innovations are rarely completely new to the world, but most often, business model innovators adapt already existing business models – even in those cases where the business model innovation turns out to be highly successful (Gassmann et al., 2014). A study by Eurelectric (2013) suggests that "business model innovation will be at the heart of achieving [… the] potential" associated with accelerated innovation in the electric power sector (Eurelectric, 2013, p. 47). Eurelectric (2013) estimates the economic potential to accumulate to 70 billion Euros of additional GDP to the European economy by 2030.

Thus, the purpose of our article is to provide an account of the business models adopted by firms in the electrical power sector. To this end, we analyzed 280 companies and their respective business models in the electrical power sector across three countries (U.K., U.S.A., and India). The companies were sampled from two different databases (Thomson Reuters; CrunchBase) to cover both old and new firms, and the three countries were selected to represent different "energy profiles," i.e., different political and economic contexts (World Energy Council, 2015). Using qualitative approaches to emulate managers' cognitive processes, we identified 25 distinct business models that are currently adopted by firms in the electrical power sector across the three countries. The analysis of the business-model-based strategic groups yields several insights: In contrast with what an industry analysis would suggest (Cattani, Porac, & Thomas, 2017), we find that the strategic groups in the different countries differ substantially in their size as well as in

their composition (i.e., some business models are predominantly adopted by new and others by old firms) and that some firms replicate their business model internationally. Moreover, we observe that in contrast with what classical industry studies would suggest, not all business models that can be found in one country also occur in the other countries. Moreover, we identified strategic dimensions for business models in the electrical power sector that aim to serve as a typology.

These insights contribute to the academic literature and have implications for managers and policymakers: To the best of our knowledge, our study offers the most comprehensive account of current and emerging business models in the electrical power sector to date. We show that the business model emerges as a fruitful concept for categorizing competition in the electrical power sector, where factors such as geographical region, the value chain configuration, and market segments no longer define the competitive dynamics conclusively. Our framework supports scholars, managers, and policymakers in analyzing the competition, identifying market opportunities and triggering ideas of business model innovation within the electrical power sector. It helps managers identify their competitors as well as new strategic options for their firm. Our findings support policy actions in that they allow policymakers to identify business models that are associated with products, services, or customers they might wish to promote. Policymakers can subsequently shape the environment to support the respective business model. By showing which companies dominate the business-model-based strategic groups (established firms, start-ups, or both), our findings indicate which companies' policymakers might wish to target when they want to promote a given business model.

3.3. Conceptual Background on Strategic Groups and Business Models

3.3.1. (Cognitive) Strategic Groups-based archetypes in the electrical power sector

Our study identifies different business models adopted by firms in the electrical power sector. The literature on (cognitive) strategic groups (DeSarbo, Grewal, & Wang, 2009; D. Kim, 2013; Mcnamara, Deephouse, & Luce, 2003) provides a conceptual background to this endeavor (Porac, Thomas, & Baden-Fuller, 2011). Cognitive strategic groups are rooted in strategic group theory (Cheng & Chang, 2009; Day, DeSarbo, & Oliva, 1987; D. Kim, 2013; Leask & Parker, 2006; Mascarenhas, 1989), which emerged when scholars observed performance differences between companies in the same industry and started searching for an explanation for these intra-industry performance differences (Hunt,

1972). Strategic groups segment firms within the same industry into groups of firms that adopt similar strategies along relevant strategic dimensions (Hunt, 1972; Porter, 1980). Cognitive strategic groups are categorizations of competitors according to managers' mental models of the company and its competitors (D. Kim, 2013; Porac, Thomas, Wilson, Paton, & Kanfer, 1994; Reger & Huff, 1993). The cognitive strategic group approach argues that managers' mental models drive strategic decision processes and their firms' strategic actions (Thomas & Venkatraman, 1988). Managers see the strategic groups as reference points or archetypes (Panagiotou, 2007) and frequently try to conform with the group(s) they identify with and consider most legitimate (Barreto & Baden-Fuller, 2006). Thus, identification with a strategic group drives behavior and therefore organizational outcomes (Anand et al., 2012). Exploring the categories managers adopt to structure competition therefore helps understand firm prosperity, competitive dynamics in an industry, and "ultimately industry evolution" (Reger & Palmer, 1996, p. 22). The business model concept, which will be described in greater detail below, recently emerged as a dominant mental model among managers in numerous industries (Zott et al., 2011), including the energy sector and the electrical power sector in particular (EY, 2015; KPMG, 2015). The business model literature emphasizes the usefulness of the concept for analyzing one's own company as well as the competition and interactions in an industry (Teece, 2010; Zott & Amit, 2008). Following this line of thought, we analyze business models in the electrical power sector to identify strategic groups and their relevant strategic dimensions. Several scholars already laid a fundament for this endeavor by identifying specific sectoral, value chain or country specific archetypes within the scope of the energy sector. In this regard, researchers focused on specific value chain elements such as distributed energy (Wainstein & Bumpus, 2016), energy services (Burger & Luke, 2017; Hannon & Bolton, 2015; Hannon, Foxon, & Gale, 2015b), technologies or types of energy sources such as small-scale heat (Suhonen & Okkonen, 2013), electric vehicles (Bohnsack, Pinkse, & Kolk, 2014) smart grids (Shomali & Pinkse, 2016), microgrids (Hanna, Ghonima, Kleissl, Tynan, & Victor, 2017), biofuel (Nair & Paulose, 2014), specific elements of a business model such as value proposition archetypes in supply business models (Hall & Roelich, 2016) or country specific business models, e.g., India (Chaurey, Krithika, Palit, Rakesh, & Sovacool, 2012; Shrimali, Slaski, Thurber, & Zerriffi, 2011), or a comparative study of Germany, the U.S.A. and Japan for photovoltaic (PV) systems (Strupeit & Palm, 2016). Authors even define normative archetype elements for sustainable business models (Boons & Lüdeke-Freund, 2013). These studies mostly define single business models or a small cutouts of archetypes without exploring how these models may be positioned against other business models. This study aims to

fill this gap by giving a comprehensive overview across value chain elements, technologies and incumbents as well as new entrants.

3.3.2. BUSINESS MODELS

The business model represents a relatively new concept employed in academia and practice (Zott et al., 2011). The literature on business models can be divided into mainly three streams of research (Foss & Saebi, 2017b; Lambert & Davidson, 2013; Wirtz et al., 2016): as a basis for enterprise classification, an antecedent of heterogeneity in firm performance and as potential unit for innovation. In regards to classification, many scholars agree that a business model reflects the mental model applied by managers to analyze their own company and the firms in its environment, such as its current and prospective competitors (Amit & Zott, 2001; Casadesus-Masanell & Ricart, 2010; Doz & Kosonen, 2010; Gavetti et al., 2005; Kaplan, 2011; Martins et al., 2015). Following this widespread understanding, managers' mental models provide the foundation for the business models according to which our paper segments the electrical power sector into strategic groups or archetypes. For our purposes, the meaning of the term "business model" in management practice is, thus, more important than its academic definition. Conceptualizations that view the business model as the aggregation of predefined building blocks have become highly successful in practice and thus seem to be especially useful to managers (Chesbrough, 2010; Chesbrough & Rosenbloom, 2002; Gassmann et al., 2014; Osterwalder & Pigneur, 2010). While these conceptualizations share the same overarching idea, they differ in the number of building blocks or dimensions they define: Osterwalder and Pigneur (2010) use nine building blocks to describe a business model, whereas Chesbrough (Chesbrough, 2010; Chesbrough & Rosenbloom, 2002) uses six, and Gassmann et al. (2014) four. In our analysis, we adopt the description of Gassmann et al. (2014), since the model is a quintessential account of the different conceptualizations and can accommodate the conceptualizations of both Osterwalder and Pigneur (2010) and Chesbrough (2010). Therefore, we define the elements of our research framework for the following analysis as follows:

- **Value Proposition**: The value proposition describes what the firm offers to the target customer. It comprises products and services that are of value to the customer (Osterwalder, 2004).
- **Value Chain**: To build and distribute the value proposition, a firm has to perform several processes and activities. The Value Chain dimension covers these processes and activities, along with the resources, capabilities, and orchestration they involve (Hedman & Kalling, 2003; Morris, Schindehutte, & Allen, 2005).

- **Customer**: Every business model serves a certain customer group (Chesbrough & Rosenbloom, 2002; Hamel, 2000; Magretta, 2002). Morris et al. (2005, p. 730) highlight the relevance of this dimension by noting that the "failure to adequately define the market is a key factor associated with venture failure."
- **Profit Mechanism**: This dimension explains why the business model is financially viable. It covers the firm's cost structure as well as the applied revenue mechanisms (Gassmann et al., 2014: 7). Examples of different revenue mechanisms are charging customers per unit sold vs. letting them pay a fixed fee over a certain period of time for providing them with access to a product or service. The profit mechanism dimension addresses a very fundamental question for firms, namely, how they intend to earn money.

3.3.3. Introduction to Empirical Context

To better put the identified business model archetypes into context, we briefly introduce the countries under study regarding the energy-related data and environment.

		India	U.K.	U.S.A.
Energy mix (%of total, 2017)	Coal	75.3	22.8	34.2
	Natural gas	4.9	29.7	31.9
	Oil	1.7	0.6	0.9
	Hydropower	10	1,9	5,8
	Renewable sources	5.4	23.0	7.4
	Nuclear power	2.8	21.0	19.3
Access to electricity (% of population, 2016)[3]		85 (98 urban; 78 rural)	100	100
CO_2 emissions (kg per PPP $ of GDP, 2014)[1]		0.3	0.16	0.3
Electric power consumption (kWh per capita, 2014)[2]		805	5,130	12,984
Electric power transmission and distribution losses (% of output, 2014)[2]		19.4	8.3	5.9
Energy imports, net (% of energy use)[2]		34.3	40	9.2
Electricity production from renewable sources 2005 – 2015[2] (CAGR)		13.3%	22.4%	12.9%

[3] (World Bank, 2018)

Renewable electricity share (% of total electricity output) **2005 – 2015**[4](CAGR)	- 0.8	19.2	4.4
Renewable energy growth (% of total electricity output) **forecasts 2018 - 2023**[5](CAGR)	10.5	7.2	4.2
Market design	• Unbundled[4] • Wholesale markets[4] • Generation and transmission is state-owned[4]	• Unbundled[6] • Contracts-for-difference[5] • Capacity mechanism[5] • Emission performance standard[5] • Carbon floor price[5]	• Unbundled[7] • Mostly wholesale markets[6] • Ten different independent system operator (ISO) or regional transmission organizations (RTO)
Particularities	• Weak financial health of utilities and the overall sector[8]		

Table 3-1 Empirical setting – electrical business model related country profiles

3.4. METHODS AND DATA

The purpose of this study is to identify currently employed business models in the electrical power sector and their strategic dimensions. As the regulatory environment and other local conditions can affect the viability of different business models, we examine the business models of firms from the electrical power sector in different countries.

To achieve this goal, the study applied qualitative methods. Since the construct under consideration (business model) is complex and hard to measure (Massa et al., 2017; Wirtz et al., 2016), given this context of study a qualitative approach is most suitable (Gehman et al., 2018). Additionally, recent research stresses the value of applying qualitative methods (Panagiotou, 2007) and the importance of industry knowledge for conducting strategic group (Leask & Parker, 2006) and business model analysis (Tallman, Luo, & Buckley, 2017). Our qualitative approach involved two researchers that conducted the analysis. These researchers each possess more than three years of experience in the

[4] (IEA, 2018)
[5] (Shukla & Thampy, 2011; Thakur, Deshmukh, Kaushik, & Kulshrestha, 2005)
[6] (OFGEM, 2016; Waddams Price, 2005)
[7] (Borenstein & Bushnell, 2015)
[8] (M. Kapoor, 2017; Mukherjee, 2018)

electrical power sector as consultants and researchers. As an additional preventive measure against random clustering, we continuously compared the evolving strategic groups of each independent researcher against the others throughout the research.

3.4.1. SAMPLE

Firm characteristics and environmental conditions (e.g., the regulatory framework in the focal location) affect which business model a firm can pursue profitably (Richter, 2013; Shefer & Frenkel, 2005). To be able to present a more comprehensive picture of business models applied in the electric power sector on an international scale, we included firms from a set of countries that are "polar types" (extreme cases) with respect to the regulatory framework and other local conditions (Eisenhardt & Graebner, 2007). These effects, in turn, are beneficial for our categorization of firms into business-model-based strategic groups (see Clark & Montgomery, 1999). In addition to examining different geographical locations, we also examine different organizational life-cycle stages, i.e., we sampled both old and new firms. Organizational age is an important firm characteristic that has implications for different aspects of the firm's operations, e.g., organizational rigidities and inertia, innovation, and productivity (Huergo & Jaumandreu, 2004; Leonard-Barton, 1992; Van Praag & Versloot, 2007) and is found to explain industry dynamics (Porter, 1980), the emergence of dominant designs (Christensen et al., 1998; Utterback, 1996), and industry shake-ups (Christensen, 2013). Our sampling approach proceeded as follows.

First, to include cases from start-ups as well as old firms, we choose two different sources of data: The first source was the Thomson Reuters I/B/E/S database, which covers mature firms. As industry boundaries within the energy sector and adjacent industries become increasingly blurred (e.g., Erlinghagen & Markard, 2012), we did not select firms based on industry codes. Instead, we selected all firms whose extended business description contained the words "electric*" and/or "energ*." The second source was the CrunchBase database (www.crunchbase.com), which covers new firms. The CrunchBase database provides extensive information on investments in start-ups[9]. We sampled companies from CrunchBase's "energy" category. We combined the two data sources and excluded duplicate entries and firms, which were not relevant for our purpose (e.g., holdings or oil, gas, and mining).

Second, we included only cases from countries with "polar" regulatory frameworks and other local conditions. To identify such "polar type" countries, we employed a study of the World Energy Council (2015), which grouped countries into five "polar type"

[9] For the purpose of this study we define start-ups as a company that recently entered the market (less than five years ago).

cross-regional energy profiles (World Energy Council, 2015, p. 32). The five cross-regional energy profiles and this country ranking informed the selection of countries for our study. From each cross-regional country profile, we took the highest-ranked country, for which we could locate at least 30 cases in both the CrunchBase and the Thomson Reuters databases. The lower limit of 30 observations per profile and database resulted from our targeted sample size of approximately 300 observations. The target of approximately 300 observations was, in turn, derived from previous research (Dolnicar, 2002). The United States of America (fossil-fueled), the United Kingdom (pack leader), and India (highly industrialized) were the highest-ranked countries within these profiles with sufficient data. Our analysis therefore focuses on these three countries (see Table 1).

Data source	**Number of examples in sample**	**Analyzed examples**		**Focus**
Thomson Reuters	U.K.:3805	U.K.:50	150	Worldwide comprehensive company information database on financial and nonfinancial data.
	U.S.A.:20563	U.S.A.:50		
	IND:3250	IND: 50		
CrunchBase	U.K.:602	U.K.:50	130	Leading international platform for information on the start-up ecosystem
	U.S.A.:1544	U.S.A:50		
	IND:30	IND: 30		

Table 3-2 Overview of data sources

For countries where the databases contained more than 50 companies, we thus drew a random sample of 50 companies from each data source for each of these cases. Thus, we obtain a total of 100 companies from the U.K. (50 companies from Thomson Reuters/50 companies from CrunchBase), 100 companies from the U.S.A. (50/50), and 80 companies from India (50/30). Accordingly, our final sample comprised 280 cases from established and start-up firms. To include only business models with a sustaining character, we checked for bankruptcy and third-party funding (e.g., banks and venture capitalists) and used this as a proxy.

3.4.2. Data Collection

Drawing on secondary data for organizational categorization is a well-established method within strategy and cognition research, as they capture the organization's and manager's views contemporaneously (see Kaplan, 2011). Consequently, we gathered publicly avail-

able data on the firms that we had extracted from the Thomson Reuters and CrunchBase databases. In addition to information from Thomson Reuters and CrunchBase themselves, we collected information from company homepages, reports, presentations, financial reports, newsletters, industry exhibitions, and published interviews. Altogether, approximately 650 distinct items were included in the analysis. Subsequently, we compiled a case database from the information we collected, which gives a detailed overview of each individual firm.

3.4.3. DATA ANALYSIS

The data analysis and categorization of the examples followed the process of Clark and Montgomery (Clark & Montgomery, 1999) for categorization of competitors (see Figure 3-1).

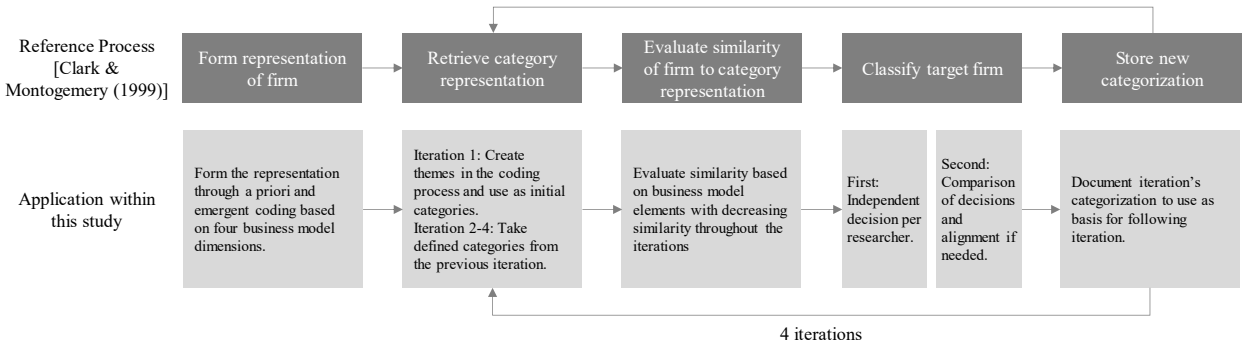

Figure 3-1 Reference Process

First, we coded the collected data according to a priori codes and emergent coding. The four previously defined elements of the business model served as guiding framework for the data analysis and as priori codes. However, due to the heterogeneity of our data, we specifically embraced emergent codes in the process (Andrade, 2009). This first step of coding of each business model element served as basis for further categorization (Richards & Morse, 2012). We followed an iterative coding process until interchangeability of indicators was achieved (Holton & Walsh, 2016) and used the first coding as initial categorizations for the process of Clark and Montgomery (Clark & Montgomery, 1999).

Practically, to avoid confounding the business-model categorization with effects rooted in traditional categorization criteria such as firm size, name, location, and age, we blinded the information on these criteria for the analysis and used separate groups of researchers for the data collection and the analysis phase. Following the coding, our postcoding analysis comprised four rounds of iteration, where within each round, the similarity of an example (firm) was compared to the category. To minimize subjective bias and enhance

validity, two researchers conducted each round independently first, with a harmonization of themes (business model categorization) after each round. Two industry experts who are not part of the coauthor team also provided their thoughts on the emergent categorization. After the respective iteration step was documented to avoid hindsight bias, the two researchers proceeded to the next iteration. Figure 3-2 provides examples of the common categorization that resulted at each of the four iterations.

Figure 3-2 Categorization example

The iterations were done with decreasing requirements of similarity. The first iteration categorized the 280 identified firm case examples: If the case example *was similar in all four business model dimensions*, it was added to the existing category (business model archetype). If not, a new category (business model archetype) was introduced containing the case example at hand. Then, the next case example was compared to all existing categories (business models) and was either added to an existing category (business model) or a new category (business model) was created. We repeated this process for all 280 initial case examples and ended up with 189 categories after the first iteration.

In the second and third iterations, we repeated the same process as in the first iteration with minor modifications: We used the 189 categories derived in the first iteration as case examples. In contrast to the first iteration, we added the case example currently being examined to existing categories when it *was similar in at least three business model dimensions* instead of in all four dimensions. We discussed the resulting 45 categories of this second iteration with independent experts in multiple rounds. Incorporating the expert feedback, the third iteration followed the process of the second iteration and resulted in 27 categories.

In the fourth and final iteration, we used the 27 categories as case examples, following the same process as in the other iterations. In the last iteration, however, we added the case example currently being examined to an existing category when it *was similar in at least two business model dimensions*. We stopped the process after the fourth iteration since prior research has defined two business models as being distinct, if they differ in at least two of the four dimensions (Gassmann et al., 2014). In the last iteration step, we arrived at 25 independent business model (archetypes).

3.5. FINDINGS: 25 BUSINESS MODEL ARCHETYPES

3.5.1. STRATEGIC GROUPS BASED ON BUSINESS MODEL ARCHETYPES

The analysis of the 280 companies from the three regions yielded 25 distinct business models. Table 3-3 provides a description of these business models.

Strategic Group	Value Proposition	Value Chain	Customer Segment	Revenue Mechanism	U.K.	U.S.A.	IND
Monolithic Producer	• Reliable and efficient provision of energy • Reliable and efficient operation of power plants	• High upfront investment and cost degressions in the long run through economies of scale • Actively manages risk of high upfront investments • Develops and retains knowledge on production technology	• Key accounts (B2B) with PPAs • Retailers	• Money/ kWh • Long-term contracts	-	2	13
Generation Entity Manager	• Decreased risk for investors of generation entities	• Knowledge on production technology • Knowledge on regulatory aspects	• Investor/owner of generation entity	• Revenue sharing models of owner	8	4	4
Traditional (local) Utility	• Reliable and efficient provision of energy to a defined geographical area	Vertical integration allows for risk and complexity reduction and high bargaining power	• B2B and B2C Customers in a geographical region	• Combination of fixed pricing (e.g., grid access) and variable (per kWh)	-	5	3
GenTailer	• Provision of an energy-mix based on customer needs • in a credible manner (e.g., ensuring 100% renewables)	• Controls with generation and retail all differentiating factors of the electric value chain (energy-mix and price) • Anticipates B2B customers' needs and manages flexible production portfolio	B2B customers with specific requirements to the energy-mix	• Pay-per-use (money/ kWh)	-	-	1
ProDistributor	• Cost-efficient and reliable provision of energy based on long-term contracts	• Offers competitive prices by not owning production, but as well distribution •	• Solely B2B (e.g., Retailers)	• Purchase power agreements	-	1	2
Retailer	• Tailored and flexible energy tariffs	• Specialized on retail (customer facing) and buying from wholesale markets	• Focus on private end consumers	• Money/kWh • Flexibility charges	-	1	-

Strategic Group	Value Proposition	Value Chain	Customer Segment	Revenue Mechanism	U.K.	U.S.A.	IND
Green Producer	• Renewable energy for the lowest price in a reliable way	• Planning, building, operating and maintaining of renewable decentralized energy production sites	• Retailers (B2B)	• Money/kWh	17	13	14
Green GenTailer	• Credible supplier of renewable energy as they controls the production	• Decentralized production sites with mostly one source (e.g., solar) • Retail (incl. product management)	• B2B and B2C willing to pay a surplus for renewable energy	• Money/kWh	-	-	2
Green Retailer	• Be 'true green' • Offering only renewable energy with flexible tariffs from all sources	• Energy sourcing from wholesale markets or through PPAs • Customer contact	• B2B and B2C willing to pay a surplus for renewable energy	• Margin on sold energy	1	-	1
Green Utility+	• Offers integrated energy solutions for a more sustainable way of living or operating a firm	• Orchestration of different partners to deliver ecosystems of "green" energy solutions	• B2B and B2C willing to pay a surplus for renewable energy	• Combination of pay-per-use, service fees, access fees	2	-	-
Smart Energy Solution Specialist	• Provides ICT-based products/software solutions, which are necessary for value creation in smart energy ecosystems	• Focus on competencies which energy incumbents do not have • Focus on products that are easy to scale	• B2B (Business Model Energy Partner) • End consumer	• Mix of margin on sold products, service fees, profit sharing through contracting, white-labeling	17	6	21
Energy Optimizer	• Lowering energy costs	• Knowledge on energy consumptions patterns and saving mechanisms	• Focus on B2B	• Service charge • Contracting	13	11	-
Smart Energy Service Provider	• All-in-one solutions for analyzing and optimizing the energy consumption to different criteria	• Managing customer relations • Orchestration of different Smart Energy Solution specialists • Using the optimization of	• B2B/ B2C	• Service charge • Money/kWh • Contracting	4	4	3

Strategic Group	Value Proposition	Value Chain	Customer Segment	Revenue Mechanism	U.K.	U.S.A.	IND
		energy consumption as "door opener" to sell add-on services					
Utility+	• Provides convenient access to different services, such as telecommunication, in addition to energy-related services	• Leveraging existing customer access, as well as existing knowledge and resources	• B2B/ B2C	• Predominantly service fees	3	3	-
Grid Developer and Operator	• Provides the technical infrastructure to distribute energy with high reliability at low costs	• Highly specialized personnel and knowledge on planning, building, operating and maintaining grids • Anticipates future demands for grid infrastructure	• B2B/ B2C (microgrids)	• One-time fees • Access fees	-	8	4
Flexible Energy Provider	• Offers ultraflexible energy supply and demand	• Owns highly responsive production and storage infrastructure	• Network Manager	• Arbitrage on prices	5	5	-
Local4Local	• Local optimization of energy supply and demand across several energy sources (e.g., waste, heat, electricity)	• Understanding of local imbalances of supply and demand across different energy sources • Connect different supply and demand entities	• Different supply and demand entities with geographical proximity	• Service fee • Contracting models	7	5	2
Turn-Key-Living	• Offering security, communication, energy management as a general contractor for latest standard housing • Complexity reduction for real estate owner	• Competencies on housing and newest housing technology • Orchestration of multiple service providers	• Real estate owner	• Margin on built object • Service and maintenance fees	5	2	-

Strategic Group	Value Proposition	Value Chain	Customer Segment	Revenue Mechanism	U.K.	U.S.A.	IND
Customer Empowerment	• Provides interested customers tools to take control and optimize personal energy usage behavior	• Provision of analysis tools, detailed information on different tariffs and further possibilities to save costs and/or energy	• Private end consumers (B2C)	• Contracting • Service fees • Money/ kWh	4	5	-
Virtual Power Plant	• Levels volatility in local grids induced by new production technologies, such as wind or solar	• Aggregate a large number of decentralized producers • Build a virtual power plant with stable supply, by employing information and communication technology	• Owners of decentralized production (B2B) • Network Manager	• Service fees • Money/ kWh	1	-	-
Platform Player	• Creates interfaces and platforms for devices and players in a Smart Energy ecosystem • This enables all players to benefit from resulting network effects	• Provides interfaces and technical platforms • Maintain and manage platforms and ecosystems	• Private end consumers • B2B consumers which can benefit from the networks effect the platform provides	• Access fees for B2B players • Usage fees for end consumers	5	5	-
Energy Consulting	• Solving energy specific problems for the customer with extended workforce or specialized expertise	• Service oriented value chain with a focus on building up specialized knowledge and a well-educated workforce	• Predominantly B2C	• Service fees	13	11	-
Hybrid-Model	• Energy production is an enabler or byproduct for another central value proposition	• Business unit requires	• Local energy consumers where excess energy is sold to (B2B or B2C)	• Money/ kWh	-	-	11
Integrated Solar Solutions	• Easy (and everywhere) to implement solar solutions for single households • Attractive financing	• Highly standardized solar solutions • Central coordination for producers, customers and finances	• B2C in remote areas respectively high investment costs to get connected to the (national) grid	• Selling of energy (Fixed tariffs; pay-as-you-go tariffs) • Margin on sold product	-	-	4

Strategic Group	Value Proposition	Value Chain	Customer Segment	Revenue Mechanism	U.K.	U.S.A.	IND
	options for the solar system						
Off-Grid Solutions	• Electrifying remote clusters of energy demands (e.g., group of houses) as a 'mini utility'	• Procurement of products, building of the local energy system • Maintenance of the installed systems	• B2C: households/ villages in remote areas with the need of energy predominantly in the evening and night • B2B: stable and reliable energy needs (e.g., telecom tower)	• Margin on built object (energy supply system) • Maintenance fees • Selling of energy (fixed or pay-as-you-go tariffs	1	-	4

Table 3-3 Identified Business Models

The study reveals similarities and differences in the applied business models and the business-model-based strategic groups across the regions.

A first result is that the mere number of strategic groups per region shows only little variety (U.K.: 16; U.S.A.: 17; India: 16), but that the strategic groups do not apply the same set of business models in the three regions. This contradicts commonly used classification systems such as the Standard Industrial Classification (SIC), which suggest a comparable set of categories among the same classification (Cattani et al., 2017) and is in line with recent studies that question their validity (Bhojraj, Lee, & Oler, 2003). Rather, there are some business model categories that are applied in only one or two region(s) and not in the other(s). For instance, the *GenTailer* and *Green GenTailer* business models, which are characterized by the fact that they do not own transmission or distribution assets, are exclusively featured in our sample of Indian firms. This might be due to prevailing governance structures and planning processes of transmission and distribution lines in India, which causes many of the corresponding assets to be still state owned (Thakur, Deshmukh, Kaushik, & Kulshrestha, 2005). However, this regional cluster does not contain such business models as *Turn-Key-Living*, *Customer Empowerment*, or *Energy Optimizer*, which seem to be better suited to the most developed economies. As another example, we observe only the business model *Green Utility+* in the U.K. This may be a consequence of European utilities' quest for new sources of income to compensate for shrinking margins in the core business and of their status as central players for the politically enforced decarbonization of energy production (Richter, 2012). The same reasoning seems to apply to the *Virtual Power Plant*, which is a model that helps to integrate very small renewable production sites into the energy market (Aghaei & Alizadeh, 2013). This has implications for policymakers if standard classifications inform their policies.

Second, the number of strategic groups that we identified in each region exceeds the number of strategic groups that many prior studies identified in other industries (Bonetti & Schiavone, 2014; D. Kim, 2013; Leask & Parker, 2006; Porac, Thomas, Wilson, Paton, & Kanfer, 1995). However, previous research has already demonstrated that a high number of strategic groups in an industry may indeed reflect the transitional nature of the industry (Mas-Ruiz and Ruiz-Moreno, 2011). Our findings corroborate this earlier work. In addition to industry-specific reasons for the relatively high number of strategic groups that we have identified, this magnitude can also, at least in part, be attributed to our research design. Unlike other studies on strategic groups, which focused exclusively on incumbent firms, we included new entrants as well as incumbents. Such a sample easily leads to a higher number of strategic groups and does not reduce complexity as much as focusing on either incumbents or new entrants alone would. However, since new entrants

are a major force of competition within the electrical power sector (Erlinghagen & Markard, 2012b), we feel that the additional value provided by covering new entrants as well is worth a slight increase in complexity.

Third, a closer examination of the identified business models reveals that the number of firms adopting a given business model varies widely: While some business models are represented by 39 or 44 company examples (e.g., *Green Producer* or *Smart Energy Solution Specialist*), others are represented by only one (e.g., *Retailer*) or two (e.g., *Green Utility+*) companies in the sample. This, too, may be a reflection of the transitional nature of the electrical power sector where new opportunities emerge that are – at least at the moment – pursued by only a few companies while incumbents tend to spread over just a few strategic groups.

Fourth, several business models assume prominent positions in all six fields of our matrix across the three regions and the two firm maturity levels (old. vs. new). These dominant business models include the *Green Producer,* which produces and sells energy from renewable sources, and *Energy Consulting*, which offers consulting services in the energy field (please refer to Table 3-3 for more detailed descriptions of each business model). However, the strategic rationales for their prominence seem to be different across regions. On the one hand, the prevalence of the *Green Producer* business model in the U.K. and the U.S.A. is pushed by the political will to move toward a decarbonized economy as it is reflected in the Energy Act 2013 (U.K.), the Fourth Carbon Budget (U.K.), or the Wind Production Tax Credit (U.S.A.). On the other hand, the rationale for the *Green Producer* in India is mainly to ensure energy security in energetically less developed areas (cf. the Integrated Energy Policy Framework or the Deen Dayal Upadhyaya Gram Jyoti Yojana Scheme). In contrast, the prevalence of the *Smart Energy Solution Specialist*, which focuses on products such as meters or analytical software for energy management, in all six fields of our matrix seems to represent commonly favorable circumstances for products that analyze and manage energy in households or commercial use-cases in all three regions.

Fifth, mature and new companies in the same country exhibit a few differences with regard to the business models that dominate in the respective firm category. In the U.K., mature companies frequently adopt the business model *Generation Entity Manager*, which involves managing generation entities as a service provider. This business model has not been adopted by any new firm in our British sample. A reason for this disparity might be that old companies are better suited than new companies to meet the specific requirements of this business model. Due to their long-standing activities, old firms may possess competencies (such as a deep technical knowledge) and other tangible and intan-

gible assets (e.g., a strong reputation for being a reliable and trustworthy entity manager), which are essential for a successful implementation of this business model, to a higher degree than start-ups. The same mechanism could explain why in the U.S.A. the business model *Grid Developer and Operator* (which implies developing and providing technical infrastructure for energy distribution) is the most dominant among mature companies, but almost nonexistent among new companies. We observed the opposite adoption pattern with the business model *Customer Empowerment*, which relies on empowering customers to control and optimize their energy usage behavior. This business model features very prominently among new companies in the US, while mature companies rarely adopt it. This adoption pattern reflects the notion that many established firms in the electrical power sector have not concerned themselves heavily with their customers' needs and wishes, whereas a strong customer orientation is the hallmark of many start-ups (Teece, 2000). A similar adoption pattern is also present in less dominant strategic groups. While new companies in the U.K. and the U.S.A. tend to adopt customer-centric business models (e.g., *Customer Empowerment* or *Platform Player*), more mature companies adopt business models with a much more complex value delivery structure where many different partners need to be coordinated individually (e.g., *Turn-Key-Living*, which means offering latest-standard housing in terms of security, communication and energy management). Turning to India as a representative of the highly industrialized-countries category, the *Hybrid Model* is chosen by many mature companies. This business model emerges when firms, which initially produced their own energy to satisfy the demand of their own energy-intensive production processes reliably, start selling energy to external customers. That new firms do not adopt this business model could be due to its capital intensity but also the increasing availability and reliability of electrical power in India, which turns electricity into a commodity (World Bank, 2012).

Sixth, some business models are exposed to international competition. For instance, Cambridge Clean Energy, which is headquartered in the U.K. and serves emerging countries with an *Off-Grid Solutions* business model, has entered the associated strategic group in India. This example underscores the usefulness of the business model perspective for identifying competition as it shows that companies from another location can turn into competitors if they pursue a business model suited to the focal market.

3.5.2. Identified Business Model Strategic Dimensions

We further aimed to identify strategic dimensions within the business model archetypes to elaborate the option space for business models within the electrical power sector

(Müller, Marlow, & Moglia, 2016). Figure 3-3 presents the identified strategic dimensions within the described business model elements.

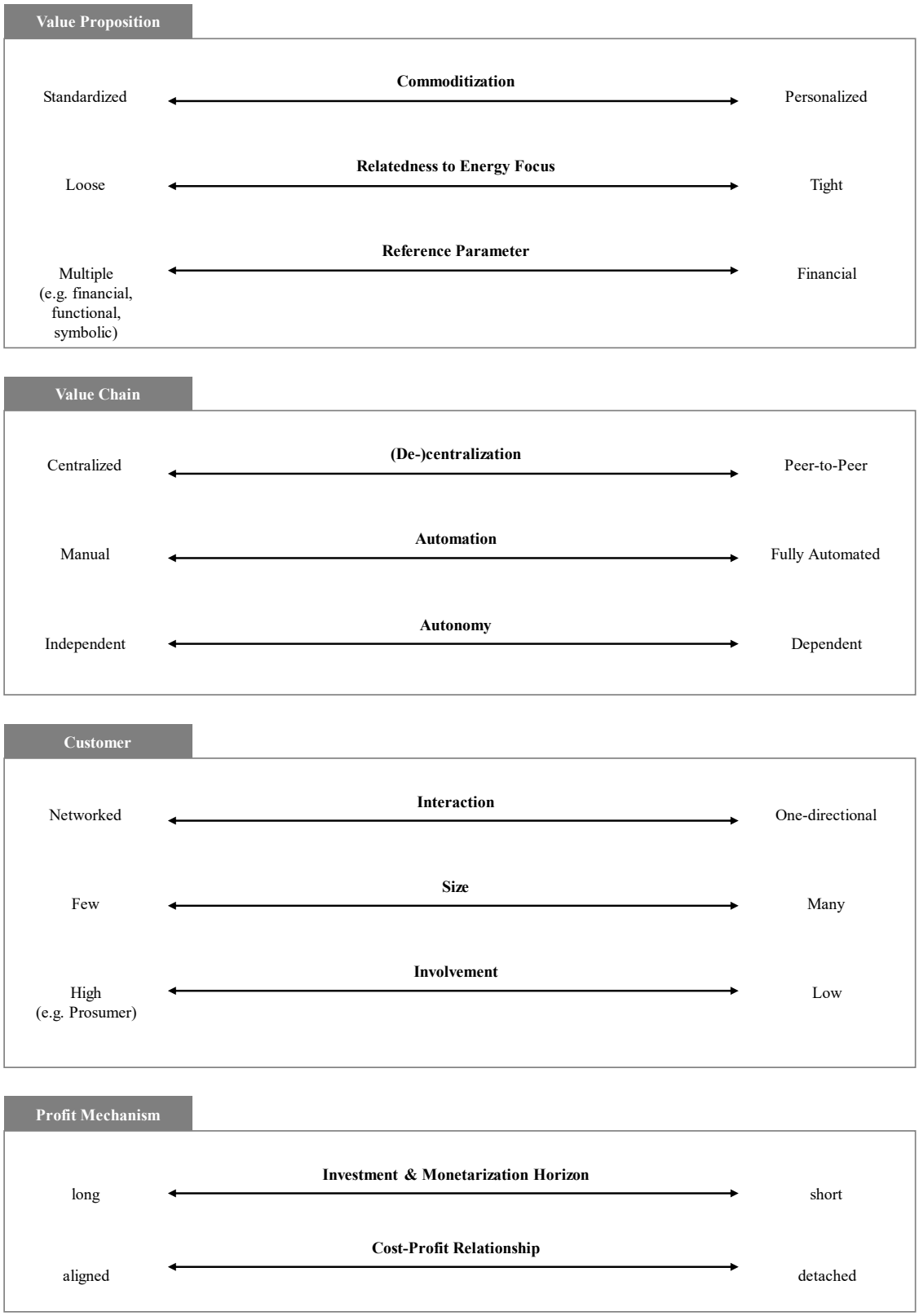

Figure 3-3 Identified Strategic Dimension

Within the *value proposition* element, we identified three key strategic dimensions. First, commoditization refers to variety and individuality of the offered value proposition. While the commodity 'electricity' still prevails in many of the identified archetypes, more personalized value propositions are found in others. Second, relatedness to energy focus describes the basis of the value proposition as either solving an energy-specific problem (e.g., Energy Optimizer) or solving a problem that loosely entails energy-specific problems (e.g., Turn-Key-Living). Third, we find that archetypes strongly vary in the value proposition's reference parameter. Reference parameters on the extremes of a continuum either focus on financial gains or contain sustainability, convenience, pride or ease of use.

Within the *value chain* element, we identified three strategic business model dimensions. First, archetypes in general differ in their level of (de)centralized value creation structure. This includes but is not limited to distributed energy resources. Next, to that, we find that the archetypes vary in the degree to which they make use of process automation. Automation here refers to all aspects of value creation. Third, archetypes differ in their degree of autonomy of value creation. Some business model archetypes heavily depend on joint value creation and thus are dependent on actors in the ecosystems. Other archetypes, however, are characterized by their high independency in value creation. These business model archetypes are defined by a high vertical integration of the necessary value creation elements.

The business model element of *customer* within the archetypes can be narrowed down to the type of interaction, size and involvement. First, the interaction differs ranging on a continuum from one-directional, to bidirectional and networked in the business model archetypes. Second, the addressable size of customer segments within the archetypes ranges from few (e.g., Off-Grid solutions) to business model archetypes that deliberately target many (e.g., Platform Player). The third dimension defines the involvement of customers in value creation. High involvements, for example, can be identified in the case of prosumers, while a low involvement can be found in highly commoditized, automated and one-directional business model archetypes.

Finally, we find that the strategic dimensions within the *profit mechanism* element are the investment and monetarization horizon as well as their relationship. The investment and monetarization horizon is either short term (e.g., for the Customer Empowerment) or long term (e.g., for Monolithic Producer with long investment horizons in power plants). Next, to that, we see that the cost-profit relationship is either aligned or detached from the cost or investment mechanism. A detached mode, for example, is given when

archetypes are characterized by short investment cycles, but in contrast with that, the revenue mechanism is rather long-term or vice versa. This can be, for example, observed in the case of the platform player or in some off-grid solutions.

3.6. CONCLUSION AND POLICY IMPLICATIONS

We analyzed the business models of 280 firms in the electrical power sector across three countries (U.K., U.S.A., and India) and found 25 distinct business models. Some of these 25 business models are adopted by companies in all three countries, whereas others are adopted in only one or two region(s) with the analyzed firms within each of these countries adopting 16 or 17 distinct business models. The business-model-based strategic groups differ significantly in their size: While some groups are populated by a comparatively large number of companies, others are rather small. Put differently, several business models, which might be pivotal for the successful transformation of the electrical power sector toward sustainable modes of energy production and use, have not yet been adopted widely and are, in particular, rarely pursued by established firms. This implies that start-ups and other new entrants are likely to assume a major role in the transformation of this sector.

With respect to the academic literature, this paper is one of the first attempts to use business models as a categorization criterion for strategic groups or archetypes. We examined the characteristics of each company's business model, while other studies focused on differences in R&D (Leask & Parker, 2006) or firm size (Mas-Ruiz & Ruiz-Moreno, 2011). This contribution is of interest given the increasing dominance of the business model as a unit of analysis (Zott et al., 2011) and the high relevance of strategic groups and cognitive models in explaining competitive dynamics in structurally highly uncertain industries (Porac et al., 2011), such as the electrical power sector.

3.6.1. MANAGEMENT IMPLICATIONS

For practitioners, our results offer an important overview of business model-based strategic groups in the electrical power sector across different regions. Categorizing the firms in the industry into strategic groups that can serve as reference points (Fiegenbaum & Thomas, 1995) makes understanding the competitive landscape easier and less complex than it would be when managers had to consider each firm in the industry individually (Reger & Huff, 1993). The increasingly dynamic and uncertain nature of the electrical power sector renders this effect especially beneficial, as complexity reduction is particularly valuable when managers suffer from information overload (Livengood & Reger,

2010; Reger & Huff, 1993). Hence, strategic groups based on business models as the key model that managers in the electrical power sector adopt to think about their own firm as well as its competition, should substantially support managers in making strategic decisions and collaborating in the changing electrical power sector (EY, 2015; KPMG, 2015).

In addition to supporting managers in better understanding the current competitive landscape, our overview of existing business models and their strategic dimensions in the electrical power sector can also stimulate their efforts to innovate their business model. As industry transitions typically stimulate firms' willingness to rethink their business model (Martins et al., 2015), managers need to understand how likely firms from other strategic groups are to contest the territory of the managers' own group and the attractiveness of other strategic groups to enter for the own firm. Overcoming the dominant logic of the firm is a key success factor for business model innovation (Chesbrough, 2010). As the business models we have identified can be used as an input to identify opportunities, our study can be of great help for decision-makers and innovation managers in their business model innovation endeavors.

3.6.2. Policy Implications

Our study also has important implications for policymakers and regulatory bodies. In line with policy and energy policy research, we look at policy instruments that not only encompass command-and-control mechanisms but are also market-based and informative (Lewis & Wiser, 2007; Park, 2015; Sovacool, 2009). First, our findings show that some strategic groups are dominated by new entrants, i.e., only new entrants pursue the business model on which the respective group is built. This observation indicates that start-ups and other new entrants can be pivotal to the successful transformation of the electrical power sector, as they may possess knowledge and competencies that are not strongly developed among the incumbent firms. This is especially the case for highly scalable business model archetypes or when new entrants excel in different skills than current incumbents. For instance, we could show that strategic groups with a strong customer orientation tend to be dominated by new firms. Generally, the more a new business model deviates from the traditional business model of incumbents and their respective core competencies, the more likely it is to be mostly pursued by new entrants. Since the energy transition is unlikely to succeed without some radically new business models (Boons & Lüdeke-Freund, 2013), policymakers wanting to promote the transition may be well-advised to increase the attractiveness of this sector to new entrants. After decades of stability and continuity, the sector's inherent innovation capacity seems limited, and it may not be sufficient to rely on incumbents for a successful and timely transition (Richter,

2013; Wassermann, Reeg, & Nienhaus, 2015). In particular, policymakers could promote collaborations between new entrants and start-ups to leverage the unique capabilities of both types of firms and stimulate progress. The promotion of such collaborations seems particularly promising where complementary strengths and weaknesses exist (Rothaermel, 2001).

Additionally, we find that there are firms that replicate their business model in foreign locations (e.g., Cambridge Clean Energy in the case of *Off-Grid Solutions*). This finding can have opposite implications: Policymakers could either try to attract foreign firms that pursue a specific business model that helps the policymakers achieve their objectives, or they might wish to implement protective measures if they want certain business models to be exclusively performed by domestic firms. This can be done by either soft instruments such as including business model perspectives in request for proposals or stronger instruments such as regulation. Either way, policymakers should be aware that international firms may enter the local electrical power sector and the business model can represent a complementary decision criteria for foreign direct investments. In both ways, the findings of this study may serve as a blueprint.

Finally, our analysis points to the effect of mental models on strategic groups and addresses mimetic behavior within groups. Implications for policymakers emerge when this finding is combined with the observation that authorities have an impact on the emergence of mental models and the formation of strategic groups (Barreto & Baden-Fuller, 2006; D. Kim, 2013). Policymakers, regulatory bodies, and other authorities should be aware of their influence on the shape of the sector. The provision of business-model related white papers, reports or workshops by legitimate authorities such as Eurelectric, the IEA, or government-related organizations can have considerable effects on the strategic behavior of firms within the electrical power sector. The authorities should therefore stress and encourage pluralism of business models when communicating with people in the sector.

3.7. LIMITATIONS AND FUTURE RESEARCH

As all research endeavors, our study is not without limitations. First, while our study provides a general overview of the business models adopted by firms in the electrical power sector across three countries, it is likely that we have not covered all emerging business models in the electrical power sector of these countries. However, by employing globally renowned data sources, a broad sampling strategy that goes beyond industry code definitions of the electrical power sector, a random selection of observations, and by including

incumbents as well as new entrants in our data set, we tried to be as comprehensive as possible and to cover the most important business models. Further research using different data sources may detect additional business models, also in the two cross-regional energy profiles that were excluded from our analysis since they were not covered extensively in the data sources we used.

Second, such as all methods, the qualitative approach applied in our paper is not without limitations and possible. On the one hand, survival bias may apply in our case. While we sampled for successful business models as the unit of analysis, factors that prevent an otherwise viable business model were outside of our consideration. Moreover, confirmation bias might be especially applicable to this study's case. Although most recent research (Cattani et al., 2017; Sonenshein, Nault, & Obodaru, 2017) supports our findings of cognitive strategic groups, we engaged in this endeavor to find archetypes that were confirmed by our study. Despite these limitations, we opted for a qualitative approach because it allowed us to include more constructs, the relationship between them; encourage equifinality in the data and finally counteract the often-raised concern of being overly simplistic in understanding organizational variation (Cattani et al., 2017; Eisenhardt, Graebner, & Sonenshein, 2016; Gehman et al., 2018). In light of the specific advantages and disadvantages of various methods, several scholars called for more qualitative work in the area of business models and strategic groups (Leask & Parker, 2006; Massa et al., 2017; Panagiotou, 2007; Tallman et al., 2017). Our study responds to this call. Nevertheless, we encourage future research to complement our qualitative approach with other methods to bring their specific strengths to bear.

Future research could periodically repeat our analysis to arrive at a longitudinal account of the business models in the electrical power sector and therefore at a description of its evolution. Given the current dynamics in the sector and the substantial role business models play for its transition, an examination of the dominant business models across time seems very promising. We hope that our study can serve as a reference point for future accounts and thereby provide a first step in this direction. Additionally, the paper could serve as a starting point to further identify specific elements such as value chain nodes that are exposed to many different business models and trigger additional studies at these nodes.

4. MANAGING RESOURCES FOR VALUE CO-CREATION[10]

4.1. ABSTRACT

Digital technologies have expanded a firm's access to resources and enhanced the effectiveness at which resources can be exchanged, combined, and integrated. This enables systems of complementary resources and consequently puts a special focus on creating value through orchestrating resources across firms and actors. While an increasing number of studies started to focus on managerial activities to orchestrate resources within a single firm or over a lifetime, the question of how firms manage resources across organizations has only been studied on a conceptual level. To overcome this knowledge gap, we conducted a multi-case study of incumbents in the energy sector that operate a so-called Virtual Power Plant, in which many owners of distributed energy sources (photovoltaic, wind, biogas) share their energy production resources. It was found that patterns of resource orchestration vary depending on whether the resources are orchestrated in their current form ('as-is') or need to be modified before they can be shared ('to-be'). Further, it was found that four distinct patterns of resource integration can be distinguished based on their degree of organizational interaction and resource interaction. Based on this, we bring forward a view of resource orchestration that includes level of the value creation relationship as a contingent element for resource orchestration.

4.2. INTRODUCTION: THE NEW ROLE OF RESOURCES

Resources of a firm in conjunction with their properties have a tradition of explaining competitive advantage in management research (Barney, 1991; Barney et al., 2011). Next to a firm's possession of VRIN resources, research collectively suggests that resources must be actively managed in processes of accumulation, bundling and leveraging within, across, and over the life-cycle of firms (Sirmon et al., 2011) to create value and sustainable competitive advantage from resources (Helfat & Raubitschek, 2018; Sirmon, Gove, & Hitt, 2008; Sirmon et al., 2011).

While the vast majority of resource-oriented research focuses on the firm and possession of resources, the profound ramifications of digitization urge researchers and managers alike to rethink resources and their value creation potential in a digitally enabled world (Amit & Han, 2017). The still ongoing spread of digital infrastructure has enabled totally new types of organizations, where the question in firms becomes: Should we create value autonomously or should we orchestrate the output and resources of others in

[10] This chapter is based on a study that has been presented at the Strategic Management Society 2018 in Houston under:

Böhm, J., Palmié, M., Bömelburg, R. & Gassmann, O. (2017). The Strategic Management of Value Co-Creation: Cases from Virtual Power Plants. In: Strategic Management Society Annual Conference, October 28-31, 2017, Houston, USA

order to create value (Parker, Van Alstyne, & Jiang, 2017)? Famously cited in practice, the most valuable companies (Forbes, 2018a) in the world—Apple, Amazon, Alphabet, Microsoft, Facebook, Alibaba—have all accumulated enormous market capitalizations by taking a "born-on-the-cloud" (Amit & Han, 2017) or "asset-light" (Kyprianou, 2018) approach, where firms predominantly manage other actors and their resources to create value (Van Alstyne et al., 2016) rather than optimizing internal value chains. Thus, this phenomenon challenges the paradigm of traditional value chain (Porter, 1985) organizations that base their competitive advantage on the possession of VRIN resources (Barney, 1991) and the formation of dynamic capabilities for managing these internal resources (Helfat et al., 2007). Contrary to the *possession* of resources, the advances in computing and communication technologies have expanded firms' reach to resources (Amit & Han, 2017) and finally the orchestration of resources *across* firms rather than firm internal, becomes central to many firms (Amit & Han, 2017; Parker et al., 2017; Sirmon et al., 2011).

To account for this phenomenon, already substantive progress has been made in recent years. Advancements in the literature on resource management as managerial capability (Helfat & Raubitschek, 2018; Sirmon et al., 2011), multi-sided markets and platforms (Eisenmann et al., 2006; Gawer, 2014; Kretschmer, Leiponen, Schilling, Vasudeva, & Ethiraj, 2017; Parker & Van Alstyne, 2017), and the sharing economy (Belk, 2014; Matzler & Kathan, 2015) have helped to understand the phenomenon and implications for management and management research. However, the ramifications of digitization increase the granularity by which the creation and capture of value can and needs to be studied (Henfridsson, Nandhakumar, Scarbrough, & Panourgias, 2018) down to the properties of the resources itself. This is especially important as digital resources are largely defined by their relationships to other resources (Henfridsson et al., 2018) and cannot be studied independently. As current studies focus on the firm or platform level, management literature might miss important mechanisms to explain interdependent value creation and capture in form of value co-creation.

Henceforth, this study examines the question of how managers' decisions for resource orchestration in a digitally enabled world need to take the properties of resources themselves into account. To elevate the features under investigation, we focus on the electricity sector where distributed energy sources become a magnitude higher valuable when virtually connected in so-called virtual power plants and actively orchestrated across firm boundaries. We find that the mechanism of how the resources are orchestrated highly impacts the value created. In some cases, the properties of the resources are

changed to orchestrate them, and in others the resources are not changed but indirect support mechanisms facilitate their orchestration.

These different mechanisms lead to varying pathways of nascent systems of resource orchestration and ultimately differ in value provision. Focusing on the resource-level mechanisms, we therefore shed light on *how* resource orchestration across firm boundaries is performed. We show the impact of orchestration mechanism in connection to value creation mechanisms. We thus contribute to the emerging literature on resource orchestration/configuration and the asset orchestration framework as we shed light on tensions managers have to pay attention to when faced with orchestrating resources across firms. We further contribute to the literature on platform ecosystems and explain pathways of platform emergence.

The article proceeds as follows: We first review the literature on resource orchestration in digitally enabled ecosystems to highlight its growing importance both in theory and practice. We then present our methods, data, and the resulting findings. We proceed to discuss the impact of digitally enabled resource configuration on value creation. We conclude with a discussion of the implication of our findings and directions for future studies.

4.3. THEORETICAL BACKGROUND ON RESOURCE ORCHESTRATION

Because building theory from qualitative cases was our objective, we allowed our emergent data to determine which theories we consulted (Eisenhardt, 1989). As this study evolved, we were guided by two theoretical lenses. First, resource orchestration theory focuses not only on the resources themselves but how they are managed and how resource orchestration creates competitive advantage by orchestrating otherwise mundane resources. Further, the literature on platforms and multi-sided markets informs our understanding on non-hierarchical structures of resource management across firm boundaries.

4.3.1. RESOURCE ORCHESTRATION ACROSS FIRM BOUNDARIES

Research interest in managers' demand to orchestrate resources within and across the firm boundaries is rather novel (Pitelis & Teece, 2017), but has recently garnered the interest of management scholars and gradually gained momentum in strategy scholarship (Pitelis & Teece, 2017). In short, resource orchestration argues that the possession of VRIN resources provides the potential for competitive advantage, but managers' resource orchestration actions are a condition sine qua non to realizing competitive advantage from these resources (Ndofor, Sirmon, & He, 2015; Pitelis & Teece, 2017; Sirmon et al.,

2011). Combining previous work on asset orchestration (Helfat et al., 2007) and resource management (Sirmon, Hitt, & Ireland, 2007), Sirmon et al. (2011) formed a unified resource orchestration framework that proposes the management of resources as the central element for the creation of competitive advantage (Sirmon et al., 2011; Symeonidou & Nicolaou, 2018). They argue that the management of resources comprises the processes of structuring, bundling, and leveraging of co-specialized assets (Sirmon et al., 2008, 2011). According to Sirmon et al. (2011), this management spans across the breadth (the scope), the depth (levels of hierarchy), and life cycle (stage of maturity) of the firm. While the depth (Chadwick, Super, & Kwon, 2015; Ndofor et al., 2015) and life cycle areas (Baert, Meuleman, Debruyne, & Wright, 2016; Carnes et al., 2016; Symeonidou & Nicolaou, 2018) of resource orchestration have been subject to further studies, the breadth of resource orchestration has only recently been studied. This is notable in the light of the ramifications of digitization and its accompanied increasing reach to resources. Helfat and Raubitschek (2018) propose that in platform ecosystems—among others—integrative capabilities for ecosystem orchestration are necessary to create and capture value. From their research we learn that integrative capabilities "provide the capacity for reliable, repeatable communication and coordination activity directed toward the introduction and modification of: products; resources and capabilities; business models" (Helfat & Raubitschek, 2018, p. 1395). In other words, resource orchestration and value co-creation in platform ecosystems is built on communication, coordination, and the introduction and modification of resources. Another study by Amit and Han (2017) provides four conceptually derived archetypes of resource configurations for value creation in a digitally enabled world. They conclude that in a digitally enabled world, only one archetype—the integrator —is resource orchestration restricted to within firms (Amit & Han, 2017). Further, Amit and Han highlight the microprocesses of connecting resources with unmet needs of prospective customers through testing, resource crowdsourcing, sorting, prospecting, grafting, and streamlining (2017). However, as Amit and Han themselves point out, the heterogeneity of resources and thus the property level of resources needs to still be incorporated in this framework. In this line, moving down to the resource level and asking the question of 'What does digitally enabled for a resource means' might infer theoretically important ramifications (Amit & Han, 2017; Henfridsson et al., 2018). In summary, current resource orchestration literature highlights the importance of managing resources across the boundaries of the firm—especially in digitally enabled contexts—as basis for value creation. The literature points to relationship-forming and resource-changing capabilities as well as the need to combine resources and needs in novel ways. However, following the hypothesis that the properties of the

resource itself impact how it can be orchestrated and ultimately its value creation potential, scholars still need to incorporate the influence of the resources' properties on resource orchestration. In reverse, these insights presumably have profound repercussions for strategy and management: The value of a resource can be analyzed in more detail and through novel lenses; for example, an ill-designed and incompatible resource might not create the aspired value and in existence of network effects impede innovation diffusion (Chen, 2018; Peres, Muller, & Mahajan, 2010).

4.3.2. PLATFORM GOVERNANCE AND RESOURCE ORCHESTRATION

Though terminology varies, literature on platforms and multi-sided markets also address the question of resource orchestration across firm boundaries. As Van Alstyne et al. point out: "With a platform, the critical asset is the community and the resources of its members. The focus of strategy shifts from controlling to orchestrating resources […]" (2016, p. 57). That focus comes naturally as platforms ease the access to a variety of distributed resources (de Reuver et al., 2017) and the general core function of platforms is to induce producers and consumers to share their ideas and resources (Van Alstyne et al., 2016, p. 60). In specific, matters of resource orchestration on platforms have evolved around the questions of platform governance (Gawer & Cusumano, 2014; Nambisan, Siegel, & Kenney, 2018; Parker & Van Alstyne, 2017; Tiwana, 2014). Governance is described as the "partitioning of decision-making authority between platform owners and app developers, control mechanisms, and pricing and pie-sharing structures" (Tiwana, 2014, p. 8). In platforms, a recognized challenge in developing platform governance, however, is how to establish mechanisms to achieve the dual goals of being simultaneously "stable and evolvable" (Wareham, Fox, & Cano Giner, 2014, p. 1196) and "to establish governance mechanisms that appropriately bound participant behavior without excessively constraining the desired level of generativity" (Wareham et al., 2014, pp. 1195–1196). Similarly, Yoo, Boland, Lyytinen, and Majchrzak note that "organizations must be designed to manage the delicate balance between generativity and control in the platform" (2012, p. 1400), a point also made by others (Constantinides, Henfridsson, & Parker, 2018; Eaton et al., 2015). Many different governance mechanisms are identified (Schreieck, Wiesche, & Krcmar, 2016). As platform governance has been primarily studied in the context of software development and platforms that heavily rely on human capital (Martin, Upham, & Klapper, 2017), it is not surprising that only a few governance mechanisms deal with physical resources themselves: *technical design* and *boundary resources* are two identified resource-specific governance mechanisms. Baldwin and Woodward (2008) put the technical design of an platform as defining platform criteria: "The fundamental feature of

a platform architecture, in our view, is that certain components remain fixed over life of the platform, while others are allowed to vary in cross-section or change over time" (p. 23). Between the components, interfaces have to be designed, which, in turn, represent the boundaries of modules (Baldwin & Woodard, 2008). How this interface design for an ex-post (after initial resource design) resource orchestration across many actors can be done is beyond the scope of Baldwin and Woodward's conceptualization.

Next to the technical design, within the subset of digital platforms, the concept of boundary resources such as the governance mechanism itself are recognized. Boundary resources, which are infrastructural resources such as APIs and software-development-kits that define the boundaries of the platform, allow diverse actors to participate in the system (Eaton et al., 2015; Henfridsson et al., 2018), and at the same time the material properties of the resource itself defines the overall resource orchestration mechanisms. In light of the work on resource orchestration, the platform literature argues that managers need to make decisions regarding the tension between control and generativity to design value creation mechanisms and have a versatile repertoire of resource and non-resource related vehicles at hand: roles, pricing and revenue sharing, boundary resources, openness, control, technical design, competitive strategy and trust.[11] However, scholars point out that additional research is needed on how governance and incentive structures can best be implemented to coordinate behavior across multiple platform stakeholders and their distinct interests (Constantinides et al., 2018) and needs to take the material properties of resources and their potential adjustments as theoretically relevant into consideration (de Reuver et al., 2017). We look into situations where managers' resource orchestration decisions potentially alter the material properties of the orchestrated resources themselves, which, in turn, becomes a governance decision in the light of platform literature.

4.3.3. Empirical setting: Resource orchestration decisions in virtual power plants

The energy sector is the backbone of modern societies and, at the moment, it is undergoing significant changes in multiple regions (Y. F. Zhang, Parker, & Kirkpatrick, 2008; Chapter 1.2.). In central Europe, whole power systems have been reconstructed since decarbonization efforts, sustainability goals, and the nuclear phase-out in several countries required new logics to produce, distribute, and consume (electrical) energy (European Climate Foundation, 2010). This reconstruction affects the size, nature, ownership, governance, and geographic dispersion of power production sites and requires new forms of

[11] For a full review see (Schreieck et al., 2017)

interaction and organization of the resources between the actors in this system to organize for the envisioned value. The described state of the sector fosters the emergence of new and hybrid forms of economic exchange (Haney & Pollitt, 2013); in particular, the diversity of new emerging roles in the sector requires embedded actors to adjust to this new reality (Haney & Pollitt, 2013). As Wüstenhagen and Menichetti (2012) point out, the majority of investments in renewable energies today stem from private investors, and production assets are owned by a variety of investor types. Energy investors are becoming a more and more heterogeneous mix of actors, including small private investors, independent power producers, cooperatives, farmers, associations, project developers, utilities, and diversified companies (Agterbosch, Vermeulen, & Glasbergen, 2004; Bergek, Mignon, & Sundberg, 2013). Specifically, the share of traditional utility-type investors has decreased significantly, and the type of ownership diverges largely from the conventional image of an energy investor (Bergek et al., 2013; Schleicher-Tappeser, 2012).

Under these conditions, the integration of various actors with their renewable energy (re-)sources and flexible energy demands is crucial for a reliable, high-quality, low-cost energy supply (Nosratabadi et al., 2017). In other words, ways of resource orchestration need to be introduced. An emerging solution to these challenges are VPPs, which can be defined as the technology-enabled aggregation of distributed energy sources and loads, wherein multiple actors give away control of energy (re-)sources (while maintaining ownership) to form a virtual power plant (Othman, Hegazy, & Abdelaziz, 2015). In a VPP, individuals join a pool with their distributed energy sources (DES), define the boundaries of how they want to participate, and give control to a central unit or other participants to 'use' and orchestrate their DES or distributed loads. The emergence of VPPs are supported by the increasing digitalization of the sector (e.g., in the form of 'smart meters,' which are capable of bidirectional communication), forming a 'smart' grid that enables the aggregation of decentralized energy sources, and energy users to a virtual system (Usman & Shami, 2013). In light of the given definitions, VPPs represent a prototypical case of resource orchestration across firm boundaries and present an ideal setting to study the phenomenon as a central function of VPP managers in the active orchestration of resources across the whole system of participating actors.

4.4. METHOD AND DATA

4.4.1. METHOD AND DATA COLLECTION

This study utilized a multiple case study approach, which is especially appropriate for studying contemporary phenomena and answering 'how' or 'why' questions (Eisenhardt,

1989; Yin, 2009). Therefore, the case study method is particularly suitable for studying the sharing activities around VPPs and answering the question of how resource integration practices in these firms work. We undertook a theoretical sampling of cases with maximum variation to specifically address the research question and to identify important shared patterns that cut across cases. We looked for firms that engaged in Virtual Power Plants with the focus of including existing resources (i.e. electrical energy sources) and their challenge being to find ways on how to orchestrate existing resources across firm boundaries. Moreover, we aimed to cover a variety of companies in terms of their maturity and experience with the concept of VPP to uncover development stages or maturity levels. However, this was only partially possible because of the novelty of the phenomenon in the energy sector. Nevertheless, our sample of case companies consisted of firms that had little experience and only a few actors who shared their resources, and of firms that already had a few years' experience and a network of actors.

Moreover, the energy sector is highly regulated and thus the phenomenon is profoundly sensitive to local regulation (Gugler, Rammerstorfer, & Schmitt, 2013), which is why we focused on comparable energy-related regulative regimes in Germany and Switzerland. We identified 22 companies in total, out of which 12 responded and 9 agreed to give access to confidential information as well as interviews with management and project managers as presented in Table 4-1.

The collection of data took place in two phases: First, our data collection focused on the operators of Virtual Power Plants (incumbent firms). We conducted 17 interviews (either face-to-face or by phone) that lasted between 35 and 90 minutes, as well as 23 follow-up interviews (Table 4-2). For the follow-up interviews, we contacted those previously interviewed and drew on our first set of findings on sharing and resource integration practices. The follow-up interviews were more focused on the topic of the initially identified patterns of customized and standardized sharing (see Findings). All interviews were recorded on tape and transcribed afterwards (except one, where the interviewee did not agree to be recorded and transcribed), which resulted in 127 pages of primary interview data. Additionally, we were granted access to internal data sources such as organizational charts, presentations, and memos, and more than 160 pages of material were collected.

During the execution of all interviews, we followed an iterative approach and continuously amended the interview guidelines with new insights gained from previous interviews (Siggelkow, 2007).

Case	Operating Sectors	Revenue	Employees/ in VPP	VPP activities since	Interviews + follow-ups
Case A	Renewable Energies, Energy Trading, VPP	273 Mio. €	120/100	2010	3+5
Case B	Local Utility	140 Mio. €	260/4	2012	2+1
Case C	Local Utility	80 Mio. €	150/5	2004	2+2
Case D	National Utility	6,6 B. €	8850/12	2010	4+2
Case E	Local Utility	290 Mio €	510/3	2014	1+3
Case F	Renewable Energies, VPP	-	-	2015	1+1
Case G	Multi-National Utility, Transmission Grid Operator	6.7 B. €	8350/50	2010	2+4
Case H	Multi-National Utility	116 B. €	56500/70	2014	1+3
Case I	Technology Provider	75.6 B. €	348000/n/a	2009	1+2

Table 4-1 Overview of Cases

In the second data collection phase, we conducted interviews with actors who shared their resources to be used by those in the VPP in order to account for the eco-systemic nature of the phenomenon. We found that the incumbents' knowledge about other actors in the ecosystem, such as the resource contributors, was very limited and that a further understanding of their motives, processes, and behaviors would advance our understanding of resource orchestration practices in a VPP. We therefore asked the previously interviewed case firms to bring us into contact with their partners, which two companies agreed to do. Out of the provided contacts, five were willing to participate in an interview. To enrich the data set, we identified owners of renewable energy sources and contacted them via e-mail or telephone. We contacted 52 actors of flexible energy production sites, of which 32 replied and 15 confirmed they were engaged in a Virtual Power Plant. Unfortunately, only two felt comfortable offering insights on the topic. Therefore, we were able to conduct an additional seven interviews, with two follow-up interviews. To distinguish the case firms from the interviewed actors in the second phase, we term the former ones 'cases' and the latter 'actors' when referring to specific quotes. Overall, the summary of our data sources is presented in Table 4-3. The relatively low response rate is likely due to the fact that these resources typically do not represent the primary business for the partner. Thus, their attention on these resources is typically secondary.

Actors	Actor's Role	Affiliation	Size production site (in kW_{el})	Owner since	Joined VPP	Interviews + follow-ups
Actor 1	Owner RES	Case A	75	2002	2013	1

Actor 2	Owner RES	Case A	80	1999	2015	1+1
Actor 3	Cooperative RES	Case A	150	2005	2014	1
Actor 4	Cooperative RES	Case B	260	2006	2012	1
Actor 5	Owner RES	Case B	150-	2006	2013	1+1
Actor 6	Owner RES	-	80	2003	2013	1
Actor 7	Owner RES	-	120	2004	2012	1

Table 4-2 Overview of additional interviews

Data Source	Volume	Details
Interviews (focal firm)	17 interviews ranging from 45 min – 1.5h	Interviews with CEOs, Business Unit Heads and Product Managers
Interviews (partners/ actors)	6 interviews ranging from 20 min – 40 min	Interviews with owners of decentralized energy production sites, such as biomass, solar and wind; interviewees were either individuals with a small enterprise or specialized companies
Internal Documents	45 pages	Internal presentations, internal studies, internal sales material, and training modules
External Documents	115 pages / approx. 45 min of video	Media releases, interviews, presentations, videos

Table 4-3 Overview of Case Data Sources

4.4.2. DATA ANALYSIS

The gathered data was then independently coded and analyzed by the authors and two research assistants (Mayring, 2007). We performed all phases of the analysis using Atlas Ti software. First, we performed open coding by analyzing phrases and sentences in all the data sources, searching for and categorizing meanings attributed to sharing practices, resource integration activities, and business models for VPPs. To diminish recall and rationalization bias and to enhance the consistency of our results, we triangulated our collected interview data with internal company data (Davis & Eisenhardt, 2011). In establishing an iterative research approach, as suggested by Siggelkow (2007) in an Editor's Forum of the *Academy of Management Journal,* we arranged the data analysis iteratively with feedback between the data and emerging themes (Locke, 2001; Miles & Huberman, 1984). At the beginning, we wanted to understand how firms deal with sharing and the new roles of the involved actors in general. However, the topic of different resource integration practices occurred very early in the analysis, so we devoted the follow-up interviews to specific questions regarding resource integration practices and integrated new

actors into our data sample. As such, our initial coding scheme included, amongst others, themes such as business models, prosumers, stakeholders, and networks whereas our final coding scheme predominantly focused on resource orchestration practices. Every statement was paraphrased and compared to gain a better understanding of how the respondents perceived the world (Locke, 2001), and the results were compared through a cross-case analysis (Eisenhardt, 1989). This holistic and embedded approach allowed for an in-depth view of the research subject in addition to the deduction of general practices (Yin, 2009).

4.5. FINDING PATTERNS OF RESOURCE ORCHESTRATION

4.5.1. ORCHESTRATING AS-IS VERSUS TO-BE RESOURCES

In our study of resource orchestration practices in the context of Virtual Power Plants in Germany and Switzerland, we found that the resource itself and its properties and aspired value creation mechanisms shape resource orchestration practices. Thus, as hypothesized, we confirm that attention to the property level of resources is necessary in all firms that aim to create value through tapping into resources outside of their organization as in the case of platforms.

Despite the cases being highly comparable in some boundary conditions (e.g., technologies, assets, etc.), interviewed firms and actors alike showed diverging responses and intentions for participating in VPPs. Specifically, the respondents offered opposing assessments as to what resource-related factors (e.g., level of investments or the degree of standardization) should look like in order to arrive at a successful orchestration across the VPPs. Likewise, actors that enter their resources into the VPP's resource pool define a successful participation in a VPP differently. In other words, they gain value out of different factors and value creation mechanisms. We found that these opposing responses can be categorized as a focus on *as-is* versus a focus on *to-be* practice of resource orchestration. *As-is* orchestration is represented by practices that take the resource *as-is* (i.e., the object is shared without being modified beforehand) and the orchestration is done 'manually' through interaction between the two or more actors. This is opposed to the *to-be* resource orchestration practice that focuses on changing the resource before sharing it. In this form, managers take action to change the properties of the resource itself to then be entered into the pool with other resources.

On one side of the continuum between *as-is* vs. *to be* orchestration, standardization and low interaction between actors were seen as the key factors of success, as one interviewee responded:

> "It [taking part in the Virtual Power Plant] needs to be very simple and standardized for the partners in order to make it a [business] case for them. If the partners need to change their behavior or processes, they will not be willing to share their assets." (Case H)

On the other side of the continuum, individual consideration and support (with a high degree of interaction) was seen as key success factor, as the following statement illustrates:

> "You need to help the partner to think about his resources in a different way. In order to achieve that, you need to work very closely with them, adapting their processes and energy producing assets, so they are willing to share them with you." (Case D)

This antagonism between standardized versus customized resource orchestration materialized and repeated itself throughout multiple topics as summarized below:

(a) The nature, direction and frequency of *communication* between actors:

> "You need to explain, in detail, what sharing in the context of energy means and especially what it means for the individual partner (which assets are shareable and which are not). This requires frequent interaction and communication." (Case B)

> "Communication, if there is any, is done through an online portal or through an app. Highly standardized ways of communication are key to survival in that context." (Case H)

(b) The *process* of integrating a new resource into the virtual pool:

> "Our onboarding follows a standardized process. There are limited options you can choose from (e.g., contract) that define the onboarding" (Case D, Respondent 1); "We have very standardized processes for onboarding, commercialization and billing." (Case D, Respondent 2)

> "The onboarding process—up until the object and partner are ready to be shared—can take months, when we [the firm] are already included in the planning phase of the asset." (Case F)

(c) The degree of *individualization* of contracts:

> "If we go to the customer and say: 'you first have to sign this 50-page contract […],' that won't work. Customers need standardized contracts when they want to compare different Virtual Power Plants, but we also need to keep the hurdles low." (Case H)

> "We are very flexible when it comes to the customer's needs […] and that's basically the bottom line in the context of virtual power plants… that's the same when it comes to contracts […]" (Case G)

> "We frequently adapted our contract with existing customers." (Case D)

(d) The *technical requirements*:

> "There are no standards, yet. There is still a high manual effort to make the assets ready to share." (Case D)

> "We also have to take into account other stakeholders like OEMs and develop customized solutions in an ecosystem" (Case G, Respondent 1); "We are customer friendly, and they do not need to change their behavior." (Case G, Respondent 2)

> "We offer a standardized interface that is then used by the customers." (Case F)

Some firms reported that they preferred to pursue a flexible approach toward *as-is* vs. *to-be* orchestration of their resources that takes the particular situation of the new resource into account, but most stressed an either-or approach depending on the strategy the firm wanted to follow. To summarize, Table 4-4 provides an overview of the different responses per case and shows that orchestrating can follow different patterns.

Case	**Communication**	**Contracts**	**Pre-qualification**	**Process**
Case A	As-Is / To-Be	n/a	As-Is / To-Be	As-Is / To-Be
Case B	To-Be	As-Is	To-Be	As-Is
Case C	As-Is	To-Be	As-Is	To-Be
Case D	To-Be	To-Be	To-Be	As-Is
Case E	As-Is	As-Is	To-Be	As-Is
Case F	As-Is	To-Be	As-Is	To-Be

Case G	To-Be	To-Be	As-Is / To-Be	As-Is / To-Be
Case H	As-Is / To-Be	As-Is	As-Is	As-Is / To-Be
Case I	As-Is / To-Be	To-Be	As-Is	As-Is

Table 4-4 Overview of Pattern Orientation per Case

The data further indicates that the degree to which the cases make use of digital technologies to facilitate the orchestration is a decisive criterion of a firm in following either an *as-is* or *to-be* pattern. In this context, *use of digital technologies* means that actors have to dedicate effort to change the resource and its material properties they want to share. This happens through digital enrichment of the resource. Taking the more familiar example of apartments as resources in the example of Airbnb, pre-qualification means that landlords needed to install an Airbnb-specific digital key system to be able to participate with their apartments on the platform. Firms that establish resource orchestration practices based on high efforts to use digital technologies (to-be) often reported having individualized contracts, processes, and ways of communication (see Table 4-4). However, this was not always the case, indicating further internal mechanisms.

4.5.2. DIGITALLY ENABLED INTERACTION OF ACTORS VERSUS INTERACTION OF RESOURCES

Following the previous finding, that resource orchestration in the studied context can be divided into two overarching practices, we also determined that the distinction between *as-is* and *to-be* orchestration of resources can be further refined. In this sense, the studied firms' resource orchestration practices can be described by the degree of *resource interaction* and the degree of *actor interaction*. Here, we understand *interaction* as "the process by which different things affect or change each other" (Macmillan Dictionary, 2018). This definition can cover the interaction of resources as well as the more commonly invoked interaction of actors, such as persons or organizations.

The *interaction of resources* refers to the degree to which resources of two or more actors have to be adapted to make them orchestratable for the intended method of *to-be* orchestration. When interaction of resources is *low*, affected actors need to make little investments. The orchestration of the resource can be done 'right away' without additional modifications. On the other hand, in the case of a *high* interaction of resources and thus a *to-be* method of orchestration, one or more actors need to make high investments to modify their resources to be able to integrate them in the *to-be* way of resource orchestration.

Resources can be tangible (e.g., if a small power plant needs to change the control unit to communicate with the IT-platform of the Virtual Power Plant) or intangible (e.g., if actors engaged in sharing need to acquire new knowledge to be able to share the production facility or need to adjust their internal processes to be able to participate in sharing). A high degree of resource interaction tends to be reflected in high investments, major adaption of processes, high costs of sharing, complex technical requirements, alterations of IT systems, substantial changes of habits, profound changes in management systems, and long integration times. Conversely, a low degree of resource interaction tends to be reflected in low to no investments, minor adaption of processes, no additional costs of sharing, simple technical requirements, limited alterations of IT systems, slight changes of habits, limited changes in management systems, very short integration times, and little need for knowledge transfer.

It was further found that firms aiming for a high degree of resource interaction typically intended to extend the possibilities for recombination so that value creation can exceed the mere aggregation of resources. In this way, such firms contrasted with those aiming for a low interaction of resources, where the resources are taken at their status quo, and their summative combination creates the value. Resources subjected to a high degree of interaction offer completely new ways of being shared among actors and generating additional value.

On the other hand, *interaction of organizations* refers to the degree to which organizations orchestrate resources through direct interaction with other actors. We observed that the degree of actor interaction manifests itself in several ways. First, the frequency of communication between organizations, represented by the number of distinct contacts to other actors or the number of different communication channels used by actors in the network (e.g., online platform, e-mail, telephone, instant messaging, and events), depicts the degree of actor interaction. Further, a high degree of actor interaction attempts to achieve value through coordination between many actors while a low interaction of actors aims to create value through automated communication and low ‘manual’ interaction.

Correspondingly, our data suggests that value in cases of high actor interaction is created by high numbers of included actors in the respective ecosystem and realizing network effects is one of the strategic intentions pursued by a high degree of interaction among organizations.

> "We want to become the 'Amazon' of energy… as a platform where people share their flexibility. Therefore, we need to become the number one platform for energy exchange for decentralized energy producers. This is only possible through very low entry barriers and through easy and standardized processes." (Case H)

To achieve a high number of participants, the openness of the envisioned platform was high and conversely entry-barriers needed to be very low. We found that these barriers included financial investments—where in the best case there shouldn't be any further investments into the resource—as well as cognitive barriers such as mistrust, changes in behavior, and high levels of specialized resources (e.g., technical knowledge) which impact the ability to share the object across actors' boundaries.

> "You need to explain what sharing of their flexibility really means for them. There are always fears involved as in some way we are taking their baby from them." (Case A)

A high degree of actor interaction is therefore used to address some of the barriers because communication fosters the emergence of trust, supports the provision of training for the actors, enables mutual learning, and keeps initial investment low.

Moreover, we found that a high degree of interaction between actors in some cases compensates for a lower degree of interaction between resources. Instead of investing in a greater automated option of resource orchestration, actors create a workaround that manually coordinates the orchestrating act. This point can be illustrated with the well-known example of Airbnb: To be able to share a room with someone who has booked on the platform, the 'landlord' has to manually exchange keys with the 'tenant' instead of installing an Airbnb-certified digital key system that would allow tenants to enter a room they have booked on the platform without the need for a manual exchange. Thus, Airbnb's chosen solution involves higher levels of interaction amongst actors (personal key exchange) but lower levels of interaction among resources (no need to modify the room's key system).

4.5.3. PATTERNS OF RESOURCE ORCHESTRATION

As depicted above, we found two different strategic parameters that define the resource orchestration practices in a context of orchestration across firm boundaries: interaction of resources and interaction of actors, which are summarized graphically in Figure 4-1.

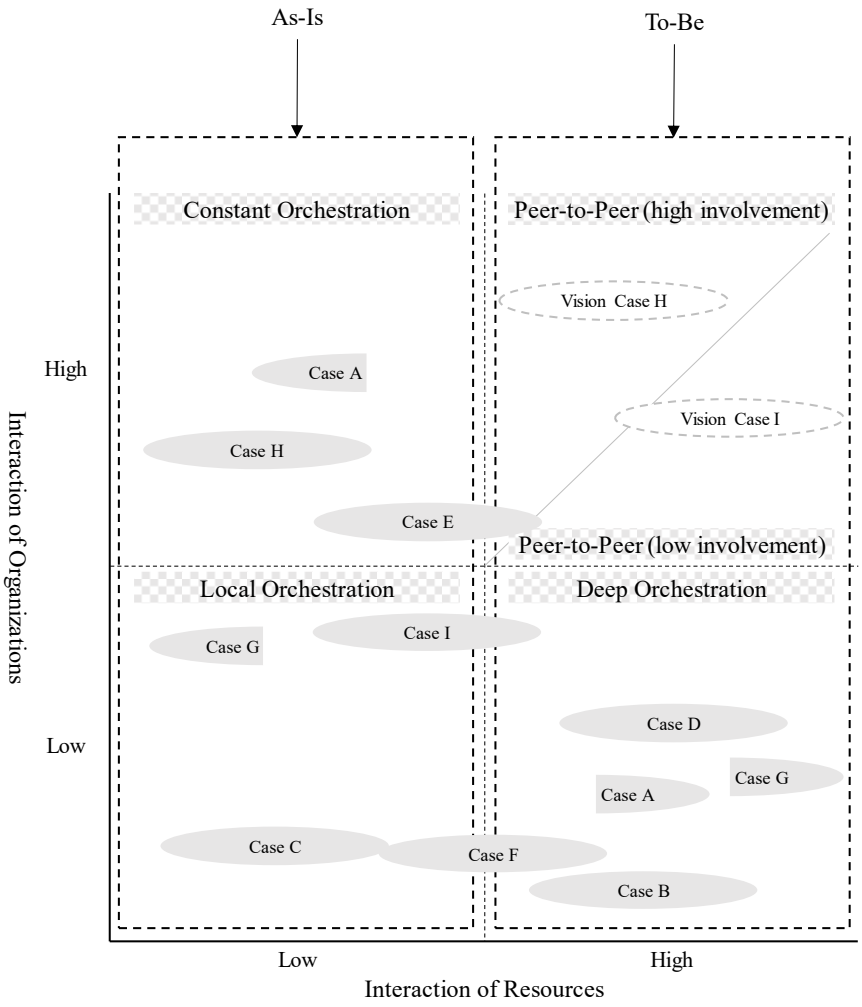

Figure 4-1 Overview of Cases and Patterns of Resource Orchestration Practices

The figure represents the patterns of resource orchestration practices for sharing identified in our cases. We term these patterns *Local Orchestration* (low interaction of organizations/low interaction of resources), *Deep Orchestration* (low interaction of organizations/high interaction of resources), *Constant Orchestration* (high interaction of organizations/low interaction of resources) and *Automated Peer-to-Peer Orchestration* (high interaction of organizations/high interaction of resources).

4.5.3.1. LOCAL ORCHESTRATION

The resource orchestration pattern *Local Orchestration* is characterized by low levels of interaction of both resources and organizations. Typically, these were cases where only a small number of actors, typically in a geographically confined area, were included. Firms often built test cases with actors with whom they had already established relationships with and entered into a new way of collaborating through the sharing of resources. Case

companies repeatedly pointed out that low levels of interaction among resources and organizations can serve as a starting point in establishing show cases. These show cases aim to demonstrate that sharing in the context of energy production works and that the firm at hand is a trusted partner.

> "Before a lot of actors join and are willing to share their resources, you have to show that it [technically] works. If you tell them: 'look here, we already have five partners and joining us means this and that,' then people are willing to participate." (Case C)

This pattern of resource orchestration involves little communication, and we could not identify a case where communication occurred outside dyadic relationships between the focal firm and its actors. This pattern of resource orchestration can be seen as a learning phase or pre-stage to the other patterns.

4.5.3.2. DEEP ORCHESTRATION

The resource orchestration pattern of *Deep Orchestration* is characterized by a low level of organizational interaction and a high level of resource interaction. We found that firms following this pattern try to establish standards and best-practices through a pre-phase of mutual learning, after which the decisions of resource adaptation are taken for the ultimate mode of orchestration. In the pre-phase, the actors' objective is to identify and understand areas of resource orchestration that increase the degree of modularization of resources and decrease the necessary degree of actor interaction in the operational phase. Multiple case companies following this pattern pointed out that they considered low actor interaction the only viable way to orchestrate other actors' resources. In their view, the resource should be adapted and foster the automation of orchestration and contribute to a to-be way of orchestration. With this, the need for actor interaction is reduced. From this perspective, case companies applying this pattern try to develop proprietary technological standards for the orchestration. A key success factor is to understand which resources are decisive to create value through combination, which underscores the importance of learning in the pre-phase. Our interviewees said that the interaction of resources and the corresponding investments invoke switching costs, which create competitive barriers and reduce the flexibility to leave the network. Several interviewees also argued that the high degree of resource interaction requires a shared vision amongst partners. The limited flexibility of changing the network because of high switching costs implies that actors have a common understanding of, and agree upon, the way objects are shared in their network. Moreover, this pattern creates the risk of mutual dependency as, due to missing

standards, only a few actors are deeply integrated with each other. Some case companies and their actors therefore tried to direct the needed investments for the *Deep Orchestration* pattern toward a higher compatibility of the resources with other VPP pools and create a meta-orchestration. This aimed to increase the combinatory power of the resource and the pool itself to reduce dependencies.

We further found that *Deep Orchestration* is a pattern often used when firms are relatively big national or international players. This is particularly interesting, as intuitively these firms could leverage their size to integrate a high number of actors into their sharing pool and try to create network effects. However, we found that, in the studied context of the energy sector, the big companies did not have a history of deep customer or external interaction, thus making it difficult for them to establish communication channels with actors and adapt their organizations to a high degree of interaction with other actors. The case companies reported having a history of very specialized knowledge (for example running nuclear power plants) and that following this pattern allows them to make the most of this knowledge. Furthermore, the actors that share their resources were mainly smaller organizations or individuals, which created resistance within the bigger companies to adapt to these small-scale organizations.

Moreover, we observed that firms tend to follow the *Deep Orchestration* pattern of resource integration when the shared resource is close to the involved actor's core processes. The closer the shared resource was to the core value creation processes of actors that entered their energy sources into the resource pool (and thus relinquished control over them to some extent), the less these actors are willing to try out an orchestration model with low interactions of actors (Actors 1, 3, 5).

4.5.3.3. CONSTANT ORCHESTRATION

The resource orchestration pattern of *Constant Orchestration* is characterized by a low interaction of resources and high interaction of actors and the idea of integrating as many shared resources into the pool of resources as possible by taking the resource as it is and sharing it in the network. As this approach does not require any additional effort for the adaption of the resources, it allows for a low level of resource orchestration. The objects that are intended to be shared can be shared right away and ideally no specific a priori investment is needed. Despite the high number of actors included, we found that their interactions remained mostly dyadic, occurring between the platform operator of the VPP and each individual actor. The platform operator's role was to ensure coordination

amongst all actors through multiple communication channels—such as online-platforms, e-mails and telephone—and a high response rate and availability.

As mentioned above, creating network effects is one strategic option for firms. We found that the greater the variety of offerings or the higher customization of offerings is decisive for actors in a VPP, and the more a strategy focuses on network effects is promising. Network effects that lead to higher variety of actors and offerings in the network can meet the demand of variety or customization on the other side. The special needs expressed by actors were, for example, regional proximity and a common vision and values:

> "I would like to decide who has access to my bio-gas plant. The best thing would be that it was someone from the region." (Actor 4)

> "For me it is important to have partners in the pool that share a common goal and values." (Actor 2)

Moreover, our analysis revealed that in contrast to the pattern of *Deep Orchestration*, which was predominantly pursued by comparatively large firms, smaller energy firms tend to focus on standardized orchestration as a pattern. Even though the smaller firms following this pattern tend to have a history of very low interaction with other actors and thus this pattern represents a divergence from the previous path, they seem to find it is easier to adapt than larger firms. Thus, smaller firms aim at building relationships with resource-sharing actors based on a high degree of organizational interaction through flexible communicative relationships.

4.5.3.4. AUTOMATED PEER-TO-PEER ORCHESTRATION

The most complex pattern of resource orchestration that emerged from our analysis was the pattern of *Automated Peer-to-Peer Orchestration*, which is characterized by a high degree of actor interaction and a high degree of resource interaction. The high degree of actor interaction manifests itself in a high number of participating actors and a network-like communication structure. Due to the peer-to-peer structure of communication, this pattern enables mutual learning among all involved actors. However, this pattern is associated with high investments into the resources to be shared in order to adapt them in light of the targeted high interaction of resources.

We further found that, within this pattern, the operator of the VPP as the central firm in the sharing network may adopt different foci in building the network. Operators may either pursue a high involvement of participating actors or they may aim at a very low involvement of actors through highly automated procedures. In the case of high involve-

ment, communication between actors is high and represents a part of the value created for the actors. In the low involvement case, sharing takes place automatically through object-to-object communication and the actors only specify some boundaries for sharing. Therefore, the low involvement case describes a situation where both the degree of resource interaction and actor interaction is high, but the individual involvement of each individual actor is low. The high degree of actor interaction is accomplished through machine-to-machine or object-to-object communication instead of via personal exchange among the actors.

As of June 2018, none of the investigated case companies operated a fully functional sharing network that adhered to the *Open Peer-to-Peer Orchestration* pattern. However, Case H and Case I were each about to launch a sharing network according to this pattern; interestingly, one wanted to adopt the pattern with a focus on high involvement and the other with an emphasis on low-involvement.

4.6. DISCUSSION AND CONCLUSION

Our qualitative analysis of resource orchestration practices yielded three essential insights: First, resource orchestration actions of managers who manage resources across organizational boundaries need to take the material properties (e.g., the level of digital enabledness) and potential changes to its properties into account. Second, based on this initial finding, we identify four patterns of resource orchestration based on the degree of organizational interaction and resource interaction pursued by the actors in the network. Third, our findings show that resource orchestration decisions taken by managers in nascent resource configurations aiming at value co-creation create strong path dependencies and thus limit potential future resource configurations. These findings have several important implications for the literature on resource orchestration and integrative capabilities, the theory on platforms and multi-sided markets and ultimately touch several aspects of value co-creation in the respective streams of literature.

4.6.1. DIFFERENTIATION OF ORCHESTRATION: AS-IS VS. TO-BE FORMS OF RESOURCES

As introduced, our findings indicate that in choosing an appropriate resource orchestration practice, the form and nature—its material properties—of the resource that actors want to share needs to be considered. In other words, the resource itself impacts resource orchestration mechanisms: Do actors decide to share the resource in its current form (*as-is*) or do they decide to modify it before sharing (*to-be*)? This distinction has not yet been

part of the research literature, which has typically focused on prominent empirical examples such as Uber, Airbnb or Couchsurfing that rely on resources in their *as-is* form[12]. Broadening the picture to also include *to-be* forms of resources is crucial as it helps scholars and managers to uncover additional opportunities for creating value through resource orchestration and opens up the scope of decisions for managers regarding resource orchestration. Thus, recognizing that a resource in its current form is not sufficiently fungible enough to be moved across actors' boundaries but may be digitally adapted to be fungible. This view on fungibility of the resource itself very well extends the resource orchestration literature and allows companies to identify additional options to build resource configurations for value co-creation (Amit & Han, 2017). Such potential modifications of resources emphasize the benefits of addressing both the interaction of actors as well as the interaction of resources when talking about resource orchestration across actor's boundaries. This differentiation would help firms to guide their strategic discussions, and it would also clarify how the "resourceness" (Peters, 2016) of an actor's resource can materialize in varying resource configurations. The resourceness, defined as "the quality and realization of potential resources […] transforms potential resources into realized resources" (Vargo & Lusch, 2014, p. 121), makes an important distinction between potential and realized value of resources. Thus, our findings are in line with an understanding of resources as "becoming" instead of ''existing'' in a situation of across organizational resource orchestration (Edvardsson, Kristensson, Magnusson, & Sundström, 2012); in this sense, the "resourceness" of resources needs to be recognized and acted upon so that potential resources become actual resources (Lusch & Vargo, 2014). However, scholars have fallen short of identifying *how* the transformation to actual resources is done (Jacobides et al., 2018). We found that the pattern of *to-be* orchestration is a way of understanding the "resourceness" of a resource across organizations in a new way and of transforming the existing resource to become an actual resource for the organization. Specific resource orchestration practices can thus be understood as resource transformation actions. A focal resource, in effect, becomes a resource only when it is deployed for a specific intended activity, and its ensuing value is derived from its use by focal actors (Löbler, 2013). We add to this and find that different patterns can lead to this "becoming" of a resource, and that for different intended activities different resource orchestration practices define the *how* of transformation. Our study shows that this is especially true for the *to-be* pattern because a resource might not be ready for the intended degree of fungibility across actors and the intended *to-be* use requires the interaction of

[12] Notably, AirBnB started to move to a higher degree of resource interaction by encouraging key boxes or keyless access.

resources. In the context of resource orchestration, this "becoming" of resources is understood as "becoming fungible" for a context or intended situation. Currently, most examples of multi-sided platforms and resource orchestration focus on resources that are already designed to be integrated in various contexts. For example, a drilling machine shared in a neighborhood has a standardized plug that allows the actors to use this resource in their own context. If the same drilling machine is taken to another context, where the plugs do not match (e.g., in a different country), the drilling machine as a resource or the context itself need to be adapted, thus leading to an interaction of resources.

On the flipside, the sharp distinction of interaction of resources and interaction of organizations could be questioned, especially in light of high transaction volumes with small transaction sizes associated with low monetary value, which should be a typical case in many VPPs. In this light, the low marginal transaction costs of high resource interaction are superior to organizational interaction and systems of resource orchestration would only survive through high interaction of resources. However, there are certain arguments that underpin the imperative of the presented duality. First, a high interaction of resources comes along with a higher loss of control over the resource. The loss of control, resulting information asymmetries, the economic risks associated with sharing and the active orchestration are found to be a major impediment to agree to participate (Ert, Fleischer, & Magen, 2016; Frenken & Schor, 2017). Second, a high interaction of resources requires investment and oftentimes creates technological lock-ins as multi-homing is prevented (de Reuver et al., 2017; McIntyre & Srinivasan, 2017). Actors that want to avoid these would decide on an orchestration through the interaction of organizations. Further, both the investments and technological lock-ins create additional risks in an already low margin environment. Third, VPPs (as many other examples such as Airbnb and Uber in their beginnings) present a still relatively new concept with technological and regulatory risks. In these contexts, innovation diffusion is found to profit from niche strategies and technological openness (Smith & Raven, 2012). Hence, resource orchestration through interaction of organizations creates a low-risk, low-investment, and flexible option and thus taps into an additional supply of resources that otherwise would not be accessible. And presents a logical strategy for innovation diffusion based on resource orchestration across firm boundaries.

4.6.2. EXTENDING OUR KNOWLEDGE ON DIGITAL ENABLEDNESS FOR RESOURCE ORCHESTRATION

Although *digital*, *digital technologies*, and the *digitally enabled* forms of resource orchestration across many actors is pivotal to the phenomenon, scholars still engage in a vivid discussion about the nature and impact of what *digital enabledness* means (Henfridsson et al., 2018; Holmström, 2018; Schreieck, Hakes, Wiesche, & Krcmar, 2017). While an implicit understanding appears to be sufficient in most instances, we find that for value that is co-created through resource orchestration across many actors that is not the case. According to our findings, the digital enablement or *to-be* of resource orchestration occurs on two separate levels. As shown, either the resources themselves can be digitally enabled, or the existing digital infrastructure can be used or built to enable the relationship. In the first case, the resource itself becomes part of digital infrastructure that could, in subsequent cases, be built on. In the second case, a previously existing digital infrastructure is used for the interaction of actors. This distinction is important in corresponding with the different levels of digital enabledness as the value creating relationship is formed on a different level (see Figure 4-2). In the *as-is* case, this relationship is formed between the actors, whereas in the *to-be* case it is formed between the resources.

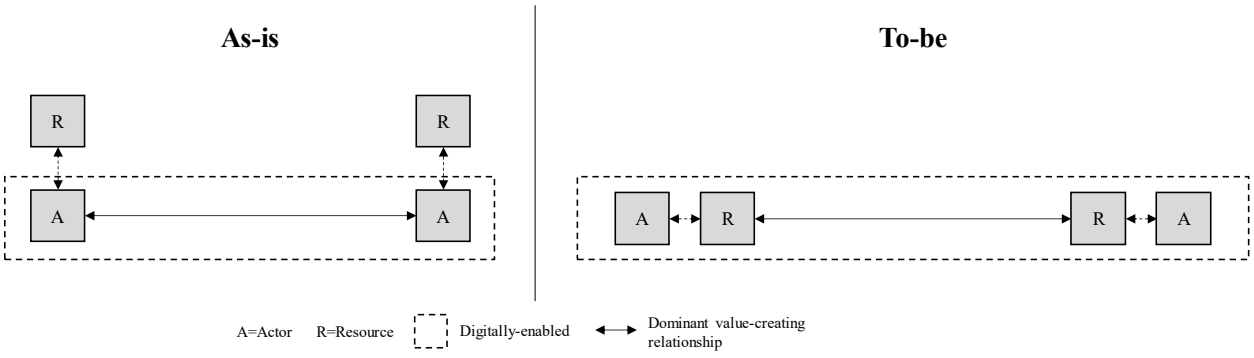

Figure 4-2 Relationship of resources - digital enabledness - resource orchestration

Thus, to discuss value creation through digitally enabled resources as has been started in various fields (Amit & Han, 2017), is in need for a more precise nomenclature and the theoretical construct of *digital enabledness* needs to be further developed to properly account for the phenomenon.

Further, our study points to managerial capabilities as being relevant in the resource orchestration decisions of managers. Each of the patterns follows disparate processes and draws on distinct capabilities, and we therefore offer a first view of resource orchestration processes across firm boundries. Specifically, the presented findings have implica-

tions for integrative capabilities (Helfat & Raubitschek, 2018). The general finding of resource orchestration through either interaction of resources or interaction of actors confirms the need of integrative capabilities (Helfat & Raubitschek, 2018). In Helfat and Raubitschek (2018, p.1397) the capabilities of "introduction and modification of resources" are needed for the interaction of resources and the capabilities of "communication and coordination" are needed for interaction of organizations. Our findings add to that and suggest that these capabilities are not equally important. Depending on the targeted value creation mechanism or life-cycle stage, these capabilities differ in their relative importance.

Moreover, it can be argued that the two differing pathways of digital enablement pose a constant challenge for managers. To repetitively resolve that tension of direct and indirect digital relationships can be seen as part of the integrative capability (Helfat & Raubitschek, 2018) and in resolving this tension, several microprocesses identified in Amit and Han (2017) present themselves as helpful: testing, sorting, and prospecting. Thus, this study established interesting links between these two studies.

4.6.3. Material properties as governance mechanism

The material properties of resources in platform contexts are typically considered to be part of the architectural decision in the way platforms' technological components function and connect to platform complements (Baldwin & Woodard, 2008; Tiwana, 2014; Venkataraman, Ceccagnoli, & Forman, 2018). It is typically assumed that the architecture and material properties make it more or less complicated to develop complements to a platform (Cennamo et al., 2018; Kapoor & Agarwal, 2017). However, it is typically viewed as an optimization problem where complementors decide to optimize their participation for one platform and offer suboptimal performance for subsequent multi-homings. This holds especially true for software platforms where typically the software code needs to be adapted, however the technological architecture on the complementor's side stays largely untouched. In cases where the technological architecture needs to be adapted (in our case in the to-be version of orchestration), the material properties become a governance mechanism. The focal orchestrating actor gets an effective additional tool to design who can be in the system and who is out. While this study established this view, it can only present a starting point for understanding the material properties of cyber-physical resources as governance mechanism.

4.7. MANAGERIAL IMPLICATIONS

Our study informs managers about decisions and needed capabilities if they are confronted with creating value from orchestrating resources across many actors. On one hand it indicates that managers need to understand the value-creating potential of different levels of digitally enabled resource relationships to decide which way resource orchestration should be handled. Further, they should consider to what extent they are capable and willing to interact with other actors. On the other hand, they must also consider to what extent their capabilities and those of their counterparts can be applied in direct digital enabled resources. For instance, a high degree of resource interaction requires more trust and mutual learning in the early phase, whereas a high interaction of organizations requires the respective organization to be able to carry out a high degree of coordination and communication. Since our study also illustrates that the interaction of resources and the interaction of actors is to some extent equifinal, managers do not necessarily need to pursue high levels of both interaction types if they want to advance resource orchestration—however, they need to actively address this tension. Finally, our study will remind managers that a mere focus on resources in their present form is likely to be short-sighted if they want to make the most of the potential value of orchestration of resources across many actors. Rather, promising new opportunities for value co-creation emerge if resources are modified accordingly.

4.8. LIMITATIONS AND PATHS FOR FUTURE RESEARCH

As with all research, our study is not without limitations. First, although our empirical setting of power production sites pooled together in a Virtual Power Plant is a prototypical example of resource orchestration across many actors, it exhibits some peculiarities: Electricity is a commodity, which may account for the finding that low interaction of organizations is a desirable way of creating value for their actors. Moreover, the technical nature of the electrical energy system requires demand and supply to be matched in very rigid limits to ensure grid stability. This technical requirement limits the flexibility of orchestration and forces external parameters on the participants. We therefore hope that future research will re-examine the resource orchestration patterns that we have identified in other circumstances. Further, additional quantitative studies should complement this research. The identified patterns suggest that the standardized orchestration should be characterized by a comparably low number of transactions over time with high value of each transaction whereas the deep orchestration is characterized by high transactions over time with comparably low value of each transaction. Using the identified classification in

conjunction with transaction data could help to further sharpen the picture. In addition, the identified direct versus indirect *digital enablement* is worth studying further. Is there a minimum level of digital enablement that permits a necessary level of fungibility of resources? Finally, quantitative research could be undertaken to examine the long-term success rates and performance implications of the various practices.

5. MANAGING VALUE CO-CREATION IN VARYING CONTEXTS[13]

5.1. ABSTRACT

Studies recurrently claim that the creation of value is highly dependent on the context of its creation. This notion becomes especially obvious when, for example, looking at Western markets compared to bottom-of-the-pyramid (BoP) markets. For firms to strive in these contexts, it is paramount to understand the fundamental changes that contextual factors pose on the creation of value. To answer this question, this study employs a polar case study design to identify contextual factors and their influence on the process of value co-creation. The narrow focus of value co-creation was taken as its context-sensitivity is highlighted in literature. Based on a comparative setting of seven Western market cases and six BoP cases, this study identifies four factors influencing the process of value co-creation. Namely, the contextual differences in levels of mutual transparency, levels of opportunity costs and risks, sizes of homogenous settings, and variety in possible value determinations influence the process of value co-creation. This study thus expands the understanding of contextual influences on value co-creation, extends the view of the process itself, and draws an interrelated view on the process of value co-creation.

5.2. INTRODUCTION: CONTEXT CANNOT BE OVERLOOKED

The ability to serve the growth markets of emerging and bottom-of-the-pyramid (BoP) markets is becoming a key factor for firms' economic success (Kolk, Rivera-Santos, Rufin, & Rufín, 2014). The completely different sociocultural, ecological, and business environments in these markets force companies to reevaluate traditional views and approaches of doing business compared to Western markets (Prahalad & Hart, 2002; Prahalad & Ramaswamy, 2013; Schuster & Holtbrügge, 2014).

As the fundamentals of these new market opportunities differ radically, firms need to sense the differences in the foundations of value creation and their inner mechanics before defining their winning strategies. Especially for BoP markets that have limited

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Böhm, J., Neumann, L. & Gassmann, O. (2017). The Impact of varying Context on Value Co-creation: Polar Cases of Western Markets and Bottom of the Pyramid (BoP) Energy Companies. In: R&D Management Conference, July 01-05, 2017, Leuven, Belgium.

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skills, knowledge, and financial resources and dwell in a more communal environment (Dey, Pandit, Saren, Bhowmick, & Woodruffe-Burton, 2016b; Meso, Musa, & Mbarika, 2005; Weidner, Rosa, & Viswanathan, 2010) the creation of value can be even more complex and fascinating, hence at the same time more challenging for firms (Dey, Pandit, Saren, Bhowmick, & Woodruffe-Burton, 2016a). For instance, where firms assumed similar value creation mechanisms for vastly differing contexts, they failed widely (Dembek, York, & Singh, 2018). This situation henceforth calls for a context-contingent view on value creation (Aquilani, Silvestri, Ioppolo, & Ruggieri, 2018; Chandler & Vargo, 2011; Kazadi, Lievens, & Mahr, 2015) as a prerequisite for innovation and successive sustainable value creation. At the same time, identifying value creation mechanisms in varying contexts enables the transfer of this learning across markets, domains, and applications. Conversely, by missing this aspect, management scholars and firms alike risk basing their decisions on an unknown, rather nebulous knowledge of their value creation.

Although the impact of context on value creation is broadly acknowledged (Bridoux & Stoelhorst, 2016; Chandler & Vargo, 2011; Roser, DeFillippi, & Samson, 2013; Xu & Meyer, 2013), many prominent models sleekly avoid a direct debate or remain on a conceptual level (Akaka et al., 2017; Kostova & Hult, 2015). To account for this gap, this study asks ***how*** contextual factors influence the co-creation of value? In doing so, we build on a growing body of research on innovations that are specifically developed for resource-constrained customers primarily in emerging and developing markets (i.e., Good-enough and Frugal Innovation) (Zeschky et al., 2014). At the same time, scholars concordantly find that the nature of value creation in BoP markets is subject to a higher complexity of value, an increasingly iterative, dialectical, and communal process, and requires greater comprehension by stakeholders (Dembek et al., 2018; Dey et al., 2016a; Gebauer, Saul, & Haldimann, 2017). As such, this study specifically looks at the co-creation of value. We are drawing on a polar case-study setting to elevate and single-out context-dependent variations in value co-creation mechanisms (Eisenhardt & Graebner, 2007; Jugdev & LaFramboise, 2012).

In general, the literature in many differing domains identifies context to have an enormous impact on the way business is conducted. Thus, a wide range of scholars from strategic management, innovation management, or marketing strongly agree with the context-sensitive nature of value creation (Ranjan & Read, 2014; Akaka & Vargo, 2015; Edvardsson, 2014; Akaka & Vargo, 2014; Roy, 2017; Lessard, 2014). So far, scholars identified the impact of context on interaction and value determination as the key factors influencing value creation. It is that interactions take place in a unique setting of ex-

change relationships and involve actors with unique set of experiences (Vargo & Lusch, 2010), roles (Ben Letaifa & Reynoso, 2015), intensity of communication (Akhilesh, 2017), and intensity of knowledge sharing (Storbacka, Brodie, Böhmann, Maglio & Nenonen, 2016) that influence interactions and shape the mechanisms of value creation. Additionally, scholars find that the determination of value itself is context-dependent. For example, a value proposition that creates value in one context might be useless in another context (Akaka, 2015; Ben Letaifa & Reynoso, 2015). Akaka (2015) therefore summarizes that value co-creation processes are dynamically framed by contextual factors at different levels, with regard to both value creation and the intertwined value determination. However, there is a consensus that despite its often-proclaimed context sensitivity and importance, the role of economic context in value (co-)creation has not yet been studied in depth (Kryvinska et al., 2013). To close this gap, this study empirically examines *how context dependent factors of value creation influence the process value co-creation of economic actors.*

Thus, this study takes an ecosystemic perspective to describe *how* value is mutually created and determined in varying contexts. To identify context-dependent, contrasting patterns of value co-creation, this study draws on a multiple polar case study from energy firms in Western and emerging market contexts and hence utilizes the rich, in-depth, and contextual description of the case study methodology to identify interaction and value determination patterns in the studied value creation systems. The contrasting markets—Western and emerging markets—are chosen to increase the variation of the dependent variable of *context*. However, to minimize the variability of variables not under investigation, we chose the identical sector for all cases. We chose the energy sector because of its equal importance in both contexts. This study therefore examines seven cases from Western markets and six cases from emerging markets in the sector of energy and ultimately gives rich insight into the varying context elements, processes, and mechanisms of influence for value co-creation in varying contexts.

This paper therefore contributes to the literature in multiple ways. First, we follow numerous calls to investigate the theoretical meso-level of value co-creation with context being one of them (Letaifa & Reynoso, 2015; Meynhardt, Chandler, & Strathoff, 2016; Wilden et al., 2017). Second, we refine the yet loosely defined term of "context" for value creation as we identify the factors of context that shape value co-creation processes. Third, we draw an interrelated picture of how these factors impact the activities of value co-creation in each step. Fourth, the study extends the current view of value co-creation

to include the perspective of transfer or scaling of the value proposition or the entire service ecosystem.

Thus, our study especially broadens the understanding of value co-creation as well as how economic actors need to act in varying contexts to create mutual value. Finally, the study gives a framework for future research to quantitively examine value co-creation activities in varying contexts.

5.3. CONTEXT-DEPENDENCY IN EMERGING ECONOMIES RESEARCH

Because building theory from qualitative polar cases was our objective, we allowed our emergent data to determine which theories we consulted (Eisenhardt, 1989). As this study evolved, we were guided by two theoretical lenses. Emerging economies research is a rich source for the internationalization strategies of MNCs in novel contexts and helped to guide the firm perspective of value creation. Next, the evolving literature on value co-creation guided us. First, this literature takes an explicit account of context-dependency for value creation. Second, recent studies point out that "1.0 BoP strategies" failed because of a lack of joint value creation consideration (Dembek et al., 2018).

5.3.1. EMERGING ECONOMIES RESEARCH

Emerging economies research finds that context differs in a variety of dimensions (Xu & Meyer, 2013) and describes the impact on business practices. It points out that value creation in these markets differs because of less efficient markets with higher information asymmetries and higher monitoring costs, as well as networked-based behaviors that alter interactions between actors and higher risk and uncertainty that make strategic decisions more difficult. For example, the literature suggests that value creation in emerging contexts is strongly influenced by institutional voids and the absence of resources or the way resources are managed (Meyer & Peng, 2016). Moreover, international business and BoP literature finds that, compared to Western markets, rules are vaguely defined, and thus firms need to rely on relationships and business networks for their value creation (Peng & Heath, 1996) or, in other words, relationships are critical to firm prosperity (Xu & Meyer, 2013), and the practices of building and maintaining these relationships differ to those in Western markets (Abosag & Lee, 2013; Batjargal, 2007; Michailova & Worm, 2003). Moreover, the argument is that, confronted with persistent uncertainty and institutional idiosyncrasies, firms develop structures that enable strategic and operational flexibility (Dixon, Meyer, & Day, 2010; Uhlenbruck, Meyer, & Hitt, 2003) and buffering of risks (Dieleman & Boddewyn, 2012). However, taken together, IB literature fails to define

context and its impact on a detailed level (Delios, 2017; Kostova & Hult, 2015; Meyer & Peng, 2017) and single-mindedly focuses on the MNCs' responses to contexts as research phenomenon (Delios, 2017). At the same time, the focus of relationships and networks in previous studies points toward an understanding of joint value creation as depicted in the conceptualizations of value co-creation (Vargo & Lusch, 2016).

5.3.2. VALUE CO-CREATION: CONTEXT-DEPENDENCY OF THE PROCESS

Value co-creation is a theoretical lens that emphasizes the creation of value through direct and indirect collaboration of firms, customers, and other actors across one or more stages of production ***and*** consumption (Frow et al., 2015; Payne et al., 2008; Prahalad & Ramaswamy, 2013; Ranjan & Read, 2016). Recent literature reviews find *co-production* and *value-in-use* (ViU) in many-to-many relationships as two constitutive process elements of value co-creation (Polese et al., 2017; Ranjan & Read, 2016).

Further, understanding the creation of value as a context-dependent undertaking is core to the conceptualization of value co-creation (Akaka, Vargo, & Schau, 2015; Chandler & Vargo, 2011; Vargo & Lusch, 2017) and thus is a fruitful origin for our research endeavor. In brief, literature on value co-creation *posits* similar contextual parameters to impact the creation of value as the emerging markets literature: interactions, the determination of value, ecosystems and institutions as determinants of value co-creation (Gummesson & Mele, 2010; Ramaswamy & Ozcan, 2018; Vargo & Lusch, 2017; Voss, Perks, Sousa, Witell, & Wünderlich, 2016). In one of their 2004 seminal articles, Prahalad and Ramaswamy (2004) bring forward a conceptual argument—although detached from a contextual perspective—that a firm that wants to engage in co-creation with customers' needs to offer dialogue, access, risk (assessments), and transparency (DART-model). Further, compared to the emerging market literature, this literature gives a richer account of explaining *why* and *how* the contextual parameters play out in the co-creation of value.

Interactions are found to take place in a unique setting of exchange relationships and involve actors with unique sets of experiences, context-dependent roles, and individual resources that all, in turn, alter the processes of value co-creation (Letaifa, Reynoso, Ben Letaifa, & Reynoso, 2015; Lusch et al., 2010; Payne et al., 2008; Siltaloppi & Nenonen, 2013). Concretely, context shapes the frequency of communication and interactions Akhilesh (2017), which enable the emergence of learning experiences and mutual understanding, build up trust, ensure a high-quality knowledge sharing, intensify engagement, and ultimately increase the co-creation of value (Mahdzan, Mohd-Any, &

Hamzah, 2017; Storbacka, Brodie, Böhmann, Maglio, & Nenonen, 2016). Interactions are further subject to the influence of institutions. Institutions, as part of the ecosystem's infrastructure, are highly context-sensitive and are especially found to impact the quality of actors' interaction (Akaka et al., 2015; Lusch & Vargo, 2014; Vargo & Lusch, 2016). Thus, institutions are found to form part of the context and shape the (co-)creation of value. In that, institutions are found to take the same dualistic role as ecosystems. At the same time, they evolve through and are shaped by actions (Bessant, Lehmann, & Moeslein, 2014; Lempinen & Rajala, 2014). On one side, institutions form the human context of interaction, which constructively guide value co-(creation) mechanisms, and as such they are regarded as enabler of value creation (Akaka et al., 2017; Vargo & Lusch, 2016). On the other side, however, institutions can also constrain value co(creation) processes (Vargo & Lusch, 2016). Holmqvist et al. (2015) add psychological distance as another key barrier for beneficiaries that hinders the engagement in ViU experiences and obstructs active collaboration.

Literature on value co-creation states that context defines "what value actually is" and thus *value* itself is context sensitive (Akaka et al., 2015). The same value proposition that appears valuable to one actor might be useless for another actor (Akaka et al., 2015, p. 217) and similarly, value propositions can generate value for an actor in one context, but might be useless in another (Letaifa et al., 2015). Thus, value co-creation is dynamically framed by contextual factors at different levels, with regard to both value creation and the intertwined value determination (Akaka et al., 2015, p. 217; Tsiotsou, 2016). This perspective of value-in-cultural context, a setting characterized by its cultural and symbolic richness, dynamism, and complexity, especially accounts for BoP markets.

In summary, current literature regards the contextual nature of value creation as highly important and identifies a plethora of independent context factors to be of importance. However, empirical literature so far is only rudimentary about *how context-dependent factors of value co-creation influence the process of value co-creation of economic actors in an integrated process perspective.*

5.4. METHOD AND DATA

This study tries to answer the question of *how context-dependent factors of value co-creation influence the process of value co-creation of economic actors in an integrated process perspective*. As we try to establish connections between the yet independent concepts of value co-creation and context, this study employs an exploratory case study design (Eisenhardt, 1989; Yin, 2009). This method is chosen in order to grasp the richest

understanding of the prevailing dynamics in the studied markets possible while taking an exploratory perspective to ensure openness for the unexpected (Gummesson, 2000; Palakshappa & Gordon, 2006). Furthermore, this study focuses on a polar case study design and takes the case itself as the unit of analysis. We thus move from the currently dominant firm/MNC dominant perspective.

We chose the polar setting of Western and BOP market contexts as they allow isolation of the central relationships between context and value co-creation. Western and BOP markets substantially differ in a variety of factors that are relevant as context-characterizing factors such as economics, policy, social-cultural structures, history, religion, social customs, and level of economic development (Bhattacharyya & Timilsina, 2010; Birol, 2007; Chikweche & Fletcher, 2012; Kanagawa & Nakata, 2008; Urban, Benders, & Moll, 2007). To increase the generalizability of the findings, the same industry sector, namely electrical power sector, is chosen for both markets. The electrical power sector is predestined to yield insightful results in a VCC context-sensitive analysis as first, electricity is a commodity and therefore the 'output' itself is highly comparable. Second, energy is highly relevant in every context and offers a comparable richness in data in each context.

Case	Market	Country	Main Operating Sector	Interviews+ follow ups
WM_Case A	Western Market	Germany	Renewable energy, Trading, VPP	3+5
WM_Case B	Western Market	Germany	Local utility	2+2
WM_Case C	Western Market	Germany	National utility	4+2
WM_Case D	Western Market	Germany	Local utility	1+3
WM_Case E	Western Market	Switzerland	Renewable energy, VPP	1+1
WM_Case F	Western Market	Switzerland	Multi-national utility, Transmission Grid, Trading	2+4
WM_Case G	Western Market	Germany	Technology provider	1+2
BOP_Case 1	BOP Market	Kenya	Lighting technology provider	2+2
BOP_Case 2	BOP Market	Kenya, Tanzania	Solar technology provider	3+2

BOP_Case 3	BOP Market	Mozambique	Cooking technology provider	2+1
BOP_Case 4	BOP Market	Tanzania	Swarm technology provider	2+2
BOP_Case 5	BOP Market	Northern/ Southern Africa	Wind power technology provider	1
BOP_Case 6	BOP Market	India	Renewable Energy (agricultural residue)	1

Table 5-1 Overview Cases

The study builds on 13 in-depth cases. The cases build on the characteristics identified in the literature such as the fact that many actors create joint value and interactions between the actors is occurring. Seven cases originate from Western markets namely from Virtual Power Plants (VPPs) in Germany, WM_Cases A, B, C, D, G, and Switzerland, WM_Cases E, F. On the other hand, the cases in the BOP markets context are based on six energy firms that offer solutions to off-grid regions. BOP_Cases 1, 2, 3 and 4 operate in at least one country in Eastern African, namely Kenya (BOP_Cases 1, 2), Tanzania (BOP_Cases 2, 4), and Mozambique (BOP_Case 3). BOP_Case 5 operates in several markets in Northern and Southern Africa. BOP_Case 6 operates in rural areas in Eastern and Southern districts of India. The data within the cases come from in-depth interviews and internal documents, and is complemented with publicly available secondary research material to reinforce the internal validity (Yin, 2009). Overall, 25 interviews and 26 follow-up interviews for eventual clarification were conducted. The interviews were face-to-face or via telephone. One author did a field trip to Africa for the face-to-face interviews in the BoP markets in spring 2017. All interviews were audio taped, transcribed, and coded.

First, the two experienced researchers and one student worked to analyze the process of value co-creation in each case separately following the guidance of Roser et al. (2013). To adequately analyze the dynamics in each case, an explicit emphasis was laid on the process identified in the literature, e.g., the degree to which actors are actively involved during interactions, the spectrum of collaboration, as well as the extent of actors' willingness to interact and the spectrum of collaboration (Skaržauskaitė, 2013). Second, each researcher conducted a cross-case pattern analysis independently, which was finally collaboratively refined to come to generalizable results.

5.5. FINDINGS: CONTEXT FACTORS AND VCC PROCESSES

We found four aspects to be evidently polar in the studied cases that affect the processes value co-creation. We find that the

- level of mutual transparency,
- opportunity costs of interaction and risks of actors,
- the size of homogenous settings,
- and multiplicity of actors' value evaluation

are polar in the cases and have an impact on joint value creation. To increase readability, we summarized the data and related findings in Table 5-2.

5.5.1. LEVEL OF MUTUAL TRANSPARENCY

First, our data confirms that the level of transparency prevailing in the respective context has a significant impact on value co-creation. We find, that through the different levels of transparency in the studied polar contexts, the processes of value co-creation were altered. Surprisingly, despite the predominantly negative connotation of the lack of transparency for value creation, our BoP cases reveal a positive effect of a low level of transparency for value co-creation. In our data, we find that actors effectively co-create value in low transparency environments even before value propositions are offered or used by actors, whereas there is little activity taking place in a setting with high levels of transparency in the Western market cases. In our cases, the transparency about participating market actors (who is a relevant actor?) and their needs (what do they want?), in particular, impact the process of value co-creation. All actors in the Western market cases are observed to (claim) to know their relevant counterparts. There is a general familiarity with prevailing institutions thanks to prior experience in the market or publicly accessible knowledge. In conclusion, the market itself is perceived as very transparent for all involved actors.

In contrast, all studied BOP market cases are characterized by a lack of transparency. We find that service offerors are often unfamiliar with the setting and dynamics of the local context they engage in. Consequently, there is a low level of market transparency for the offering actor, particularly regarding who the relevant actors and their needs are and what market logics prevail. We find these to shape the value co-creation processes significantly, but in unexpected ways. The level of transparency impacted the degree of interaction and joint resource integration to create a value proposition. In Western markets, service offerors developed their value propositions on their own, with only sporadic interaction with customers or potentially involved actors. The value propositions were clearly defined by the firms before engaging in interaction through, for example, rolling out pilot projects. In contrast to that we find that in BOP markets, firms and customers define the value proposition in a joint bottom-up process with the aim to reduce the mutual lack of transparency. This bottom-up process is characterized by high levels of inter-

action with the purpose to find and subsequently integrate all actors' relevant resources even before the clear value proposition is defined. Relevant resources are subject to iterative change as the value proposition evolves. As the data reveals, the level of transparency as context factor does not need to be decreased in Western markets, where the level of transparency is high enough to provide meaningful value propositions. In BOP markets, service offerors (firms) need to increase the level of transparency through interaction. This interaction is found to increase the potential for meaningful value co-creation between the actors.

5.5.2. OPPORTUNITY COSTS OF INTERACTION AND RISK OF ACTORS

Second, our data reveals a strong impact of actors' opportunity costs and individual risk facing on value co-creation. Actors in BoP markets showed a high willingness to interact with firms as they have very low opportunity costs and face almost no perceived risks (of interaction). Therefore, as long as the benefits exceed the opportunity costs, actors in BoP contexts are open to collaboration and interaction. We found in multiple occasions that future customers were happy just to try things out, without explicating the exact benefits in the beginning or formulating expectations. The mere *potential* of benefits was enough to engage in a relationship with another value-proposing actor such as firms. On the other hand, in Western markets we find that future customers required a very specific defined value proposition to compare the benefits of it with their perceived risks and opportunity costs. We find that the potential risk of co-destruction of value is an important factor in Western markets and that customers have a precise expectation of the benefits. Western market customers experienced a benchmark standard of value provision that the potential benefits of the new value proposition are compared against. Therefore, the sweet spot of a value proposition is found to be very narrow and is always benchmarked by the customers. These expectations are formed by institutionalized standards. In concrete, the electricity supply has become a daily normality, thus quality standards regarding the value proposition have been institutionalized, e.g., the fact that electrical energy is always available. Not meeting this institutionalized expectation poses high perceived risks for the actors and hence constrains the willingness to engage in new forms of value provision through novel value propositions.

5.5.3. SIZE OF HOMOGENOUS SETTINGS

In BOP markets, firms are observed to be confronted with a continuous spectrum of heterogeneity relating to their customers' lifestyles, routines, and set of operant and operand resources even within small geographic areas. We find that this heterogeneity is of such

significance that it alters the value co-creation mechanisms as compared to Western markets. First, we found that the context-induced heterogeneity requires a higher scale of customization of value co-creation mechanisms and subsequently complicates the process to serve a larger number of customers at once. It requires a continuous adaptation of the offered value proposition. This adaptation was often performed through reorganizing modular parts of the value proposition and filling the value proposition with local meaning is required prior to scaling. This local meaning takes into account their lifestyles, prevailing routines, and endowment with resources and thus links to the multiplicity in actors' value determination. We thus find that value proposition offering organizations strive for a very robust core value proposition, which allows for individual adaption by customers and allows for self-organization filling with meaning. We oftentimes found that the specific needs to be fulfilled or resource endowment make it important for the customers to redefine the value proposition to their context. Most interestingly, this adaptation is not necessarily driven by the originating actor.

Contrary Western markets, we found that firms are observed to know that they can expect their beneficiaries to be endowed with a similar set of resources in terms of experience with the service on one side, and skills necessary to use the value proposition on the other side. Service offerors seek to standardize their processes as much as possible, also because they know that value determination does not differ significantly between actors. Oftentimes, they offer IT platforms as a means to scale their activities in a standardized manner.

Following that, we find that the requirements for scaling are determined much more quickly by Western market actors as the extent to which beneficiaries may differ is confined to a determinable space, type of operand resources, and user patterns. Yet, standardized scalable value propositions are less likely to stimulate the co-creation of value.

However, we unexpectedly find that flexibility in value proposition scaling is a necessary condition but not sufficient to enlarge networks of co-creation. Our data from the BoP context reveals that actors not only adapt value propositions but rather create completely new logics of value co-creation. The actors create innovative forms to collaboratively generate the value proposition with their unique resource endowment fine-tuned for their local context. As a result, we found that the mechanisms of value co-creation substantially differs within geographically very close areas.

In summary, we find that the context-induced heterogeneity creates the necessity to reshape the value proposition in BoP markets through a recombinatory process of value co-

creation mechanisms. In contrast to that, Western markets are set-up to standardize the value proposition as much as possible and to leverage the resources endowment to do so.

5.5.4. MULTIPLICITY IN ACTORS' VALUE EVALUATION

Finally, we found that the degree of multiplicity in actors' incentives as a context dependent variable influences the co-creation of value. We find that all actors in the examined Western market cases are solely financially incentivized. We find that firms' and customers' willingness to engage in deep value co-creation primarily roots in a joint interest to maximize profits. The value within value co-creation is translated into a financial gain compared to the efforts. Further, the number of potential user experiences for service beneficiaries in Western markets in the electrical power sector is arguably limited by binary evaluations, where the performance is either in line with the benchmark or it is not. This binary evaluation is further constraining the possibilities VCC experimentation. The mere duality of potential outcomes results in less room for interpretation and engagement in Western markets and a narrower definition of value. While "in-line performance" is taken note of, simply meeting expectations does not necessarily evoke positive emotions in terms of conscious satisfaction. "Not-in-line performance" may even result in a negative evaluation experience, potentially destructing value, as expectations have not been met and actors integrate resources according to their expectations.

On the other hand, our data shows that in BoP cases, value was determined by a multiplicity of measures such as impact or vision from both the firm and the customer. Value propositions in BoP markets offer a variety of potential ViU experiences. There is no standardized checklist. Value evolves in unexpected, rather emotional dimensions when adapting and using the value proposition. Moreover, data shows that actors in BoP markets, contrary to actors in Western markets, demonstrate a higher interest in the value proposition, due to the multi-dimensional experience that value propositions can create. Further, a higher degree of curiosity is observed in BOP markets, which is associated with a higher willingness to consciously deal with the value proposition. This allows for more personalized and enhanced ViU experiences in BOP markets. We then found that this multi-level evaluation of value has profound impacts on interactions and subsequently the processes of joint value creation. In Western markets, the number of interactions is very limited from the beginning and later in the use phase of the value proposition. There is simply "nothing to talk about"—when the invoices and payments come in once a year, this is the only interaction. Next to that, joint profits are maximized when interaction is kept to a minimum. On the other side, in BoP cases, joint profit is maximized when inter-

action is high. We find that in BoP cases—because of the many different points to evaluate the value—there was is a variety of touchpoints to examine the full potential value together. This increases the value of the value proposition itself, but also the joint sphere of value co-creation is extended. A more experiential interaction among BOP actors, rather than neatly defined moments of interaction, is observed. However, the interaction was looser and less goal-directed than in Western market cases.

Second, companies are meeting the needs of their customers by offering different products or services at different price points while using the provision of a product or service that a customer needs to enable access to products or services that a customer wants. This process is reminiscent of bundling strategies that have a long history in the strategy of selling commodities to create a Gaussian demand curve (McAfee, McMillan, & Whinston, 1989; Schmalensee, 1984).

Identified Contextual Factor	**BoP specification**	**Findings impact on VCC BOP**	**Representative Quotes BoP**	**WM specification**	**Findings impact on VCC WM**	**Representative Quotes WM**
Level of transparency	Transparency is low	• Actors develop value propositions in a joint process with high levels of joint resource integration and interaction prior to a functioning value proposition • High levels of interaction in low transparent environments lead to co-creation • Extensive market research, interviews, prototyping testing, field trips, etc. • Large joint sphere of resource integration	• "The informal market of businesses in Africa is something that, if you do not come from Africa, you do not know what to look for. Then you get burnt in Africa very quickly" (BOP_Case 3) • "Most of [Company's name]'s team members have spent weeks or months in Tanzania or Rwanda, thus having a pretty good idea of what it means to suffer from darkness after 6 o'clock in the evening, even in urban areas during power cuts. This helps us understand how important a functioning solar home system is to our customers and how much we can do by offering a reliable and comprehensive service" (BOP_Case 2) • "We want to see what works with you [service beneficiaries], because we [service offeror] think differently and first have to find out what you need […] to provide the best practices which enable you to build up your own business" (BOP_Case 4) • "The thing is very simple, he [the service beneficiary] wants electricity. Consequently, the solution has to be simple, too. Meaning there needs to be a button, which he can switch on so that it [value proposition] works. And if it does not, then he must simply tell us what the problem is. That is the initial situation. We designed it that way, that	Transparency is high	• Actors have a general market knowledge about actor's preferences, behaviors, and institutions • Low levels of interaction • Firms develop value proposition independently • Limited joint sphere of resource integration	• "[We will perform in the market because] we know our grid, we know our customers […] we know how to approach end-customers" (WM_Case B) • "It is a) difficult to think beyond the business model of a virtual power plant and b) to bring it [a more holistic business model] to the market, as in the moment you only earn money with the production side, but not with the sales side […] we analyzed the potential in a study, we already did a lot of paperwork. Because we say, on one hand we have to prepare for it so that we have the right IT tool to manage actors on one platform. Further, in order to think of how the business model can look like, e.g., whether to integrate target storages etc." (WM_Case D)

			he does not have to do anything with the display or the configuration, the entire intelligence is in our product. Everything he has to know" (BOP_Case 4)			
Opportunity costs of interaction and risk of actors	Low opportunity costs and high potential benefits	• Actors show a high willingness to interact and 'try out' as their opportunity costs are low, and the potential benefits are almost *always* larger than zero • Higher openness of actors manifests in higher willingness to interact and share knowledge • Loosely defined and almost non-existing expectations to benchmark • Absence of negative opportunity costs • Willingness to co-create given as long as marginal expected benefits are larger than zero • Value co-destruction is mostly limited to the of-	• "[Willingness to pay] is an unknown factor, because it cannot be more expensive than existing systems […] this is a certain experiment as the purchasing power is very limited" (BOP_Case 4) • "The insecurity and unpredictability in crucial variables, such as government and security issues, presented a huge challenge and could be overcome only through close collaboration with local Kenyan partners [including] regular feedback meetings with customers. These feedback meetings in particular produce valuable information for evaluating, adapting and redesigning the products and the operational model" (BOP_Case 1) • "During the pilot phase, we will evaluate customer acceptance and analyze technical constraints" (BOP_Case 2) • "Power providers, who have been here for years, have not managed to efficiently offer high quality [energy services]" (BOP_Case 4) • "[In the market we had the] ability to deploy systems and operationalize the power plants in a way that we had not seen [done] by others" (BOP_Case 6) • "The expansion underlines the acceptance of our innovative approach for regions in which people don't have access to the power grid"	High opportunity costs and low marginal benefits	• Value proposition needs to be defined, so other actors can deliberately compare opportunity costs and risks with expected benefits • Value co-destruction is a risk for both sides • Sweet spot for a mutual willingness to co-create is limited and benchmarked across a wider range of market actors • Precise	• "Our advantage is indeed our regionality, the fact that we know our customers […] I think it all depends on us delivering high quality throughout our value chain, [but also on the fact that we have] selected business customers who feel attached to us, with whom we collaborate with a different level of risk" (WM_Case D) • "The process has to be easy, with not too much effort required and without them [as service beneficiaries] having to take risks" (WM_Case G) • "[Pricing one's service] is also about risk. Our sales people tend to say, 'People you do not take any risks at all' if they [service beneficiaries] start complaining as they have expected more [profits]" (WM_Case A) • "There is no good or bad energy, there is energy or there is no energy […] in the society it would not be accepted if availability is not 100%. That is why the price is the only decisive criteria [for the service beneficiary when selecting among offerors]" (WM_Case F) • "[As a private service beneficiary, I think that] electricity has the same value throughout the year, I am always paying the same price" (WM_Case A) • "Different tariffs for different periods of the day. I really do not believe that people would like to think about when to turn on which electric device in order to save 3,50 €. If at all, such changes have to be fully automized […] I think if humans have to steer processes themselves, this [change in pric-

		feror • Actors interpret the value proposition on multiple levels and its fit to their context as no explicit or implicit benchmarks are available	(BOP_Case 1) • "[The value proposition is] 'helping people to help themselves'" (BOP_Case 4) • "We light up a village—then the surrounding villages see it and they come asking, how can we get this too? It sells itself" (BOP_Case 6)		expectations of actors, including normative expectations (being part of 'Energiewende', doing a good thing, etc.)	ing mechanisms] will not happen" (WM_Case B) • "There is no good or bad energy, there is energy or there is no energy […] in the society it would not be accepted if availability is not 100%. That is why the price is the only decisive criteria [for the service beneficiary when selecting among offerors]" (WM_Case F)
Size of homogenous settings	Relatively low	• Hard to get to know many beneficiaries at once • Continuous adaptation of co-creation mechanisms and ongoing integration of novel resources • Robust core value proposition that is extended, refined and adapted • Continuous match between loosely defined expectations, available resources and value evaluation • Value evolves in unexpected manners through a recombinatory act on	• "I [service offeror] have worked in the communities and the only way to be really successful is by deeply analyzing the social structures. For example, in Tanzania, the Western part of the country is completely different from the Southern part. One cannot say, this [mechanism] is valid for Tanzania. There are local differences […] our business model, as we imagine it, cannot be adapted 1:1. And that is what we respected […] that is why we retreat from the market itself, he [local partner] has to invest and take ownership, I offer him after-sale services [but he is running the business locally]" (BOP_Case 4) • "Our biggest challenges relate to human resources. […] As we scale, the challenge will grow—which is yet another reason why we plan to scale mainly through franchising rather than running all the plants ourselves" (BOP_Case 6)	Relatively high	• Scaling of ready and comparable value propositions without recombination of novel elements • New users is a question of distribution rather than co-creation • Only initial and a priori defined integration of resources • Standard-	• "That [onboarding process of new service beneficiaries] is a relatively standardized process […] we do have a framework with certain criteria and associated conditions, which takes the size of the plant, the provision of flexibility and technology into account" (WM_Case A) • "I think we seek to develop similar to how Amazon did, we are striving to become the platform for flexibility […] Key performance indicator is how many plants I can manage on my platform. Therefore, you need the best technology to keep costs low when taking another plant up" (WM_Case G)

		all sides (firm, customers, other stakeholders)			ized scaling processes • Experienced beneficiaries	
Multiplicity of actors' value determinations	High	• Multiple incentives such as financial, vision, pride, independency, security • Many different co-creation touchpoints and interactions possible • Experimental interaction to find the biggest impact	• "There is really this element of magic if people experience light for the first time and it is so cool to be part of that in terms of being allowed to look at what is does in terms of changing the lives of people […] that is what drives us. We are not in for the money or to maximize profits. It comes with it, but it is really this sense of there is something happening" (BOP_Case 2). • "To develop this technology is our main motivator. We are all convinced to get away from fossil energy sources" (BOP_Case 5) • "Anybody in the world [knows that] there is not a lot of money in biofuels. You [service offeror] do biofuels because you love it and you want to do it. We are obviously serving to poor people, to the base of the pyramid […] by definition you are trying to grow and create a market for people that are poor" (BOP_Case 3) • "For us the bottom line is development benefits. We are not just sellers of electricity; we are a powerhouse of rural development. […] As our mission we're looking for empowerment; as a company we look to grow income streams" (BOP_Case 6) • "I am proud to own my personal electricity source […] At night, my family now has	Low	• Limited openness for multiple dimensions of value evaluation. Often solely financially incentivized • Limited touchpoints and interaction • Goal-oriented and efficient interaction	• "Financial incentives are still the most powerful ones, obviously, people want to earn money […] as they invest in remote units and might be worried by higher maintenance costs […] ultimately leading to the question, whether this [collaboration] is profitable?" (WM_Case A) • "The incentive to have more euros in the pockets at the end of the day is always there […] this [financial incentive] is for sure the strongest incentive [for actors to participate]" (WM_Case D) • "Everyone [wants] more revenues for their plants. This always is the value-added" (WM_Case C) • "Standardize, automate and minimize manual interaction, otherwise there are too many cases, this would not be profitable" (WM_Case F) • "Interaction is only happening, if required […] e.g., that the wind energy plant operators […] log off their plants if maintenance is conducted or malfunctions discovered, so that we know, that there is no electricity coming. This is done via our online portal" (WM_Case A) • "[After the installation] everything is processed by the IT systems. All in all, a very automized story […] we really try to provide customers with a value-add and do not seek to influence their businesses if this can be averted" (WM_Case E)

			clean and bright lights—and we can even power a refrigerator" (BOP_Case 2) • "We earned our independence from England 60 years ago, but today—when you came into our village—we got independence from poverty" (BOP_Case 6) • "We [as service offeror] try to analyze it together with them [potential service beneficiaries]. Where can we employ our solution, what is he using right now. If we have generators, what would be the disadvantage for them, what could we offer them and where would be a chance for our solution to be integrated […] In fact, we defined it [management] beforehand, but it did not work out. It is really this trial and error, learning step by step out of experience" (BOP_Case 4)			

Table 5-2 Summary data and findings

5.5.5. TOWARD A CONCEPTION OF 'CONTEXTUAL VCC'

BoP Mode—We find that contexts with low levels mutual of transparency, low opportunity costs and perceived risks, relatively low homogenous settings, and high variety of possible value determinations have impacts on the process of value co-creation. The identified process elements are illustrated in Figure 5-1. First, contexts that are defined by these factors allow for a deep phase of value co-production through interaction propelled by the need to increase transparency and low opportunity costs on the user side. Second, the high variety of possible value determinations lead to many value paths that can be followed from the process of value co-production. Third, and new to the perspective of the value co-creation process, is the idea of expanding the reach of value co-creation mechanisms. We find that in the described context, this is done *actor independently* through a *recombinatory* process that builds on original modularity from the phase of value co-production. Actor independent means that the offeror of the initial value-in-use value proposition is not necessarily the same who transfers and thus scales the value proposition. However, this requires an openness from the originator of the value proposition to allow this to happen and proactively build in modularity early on.

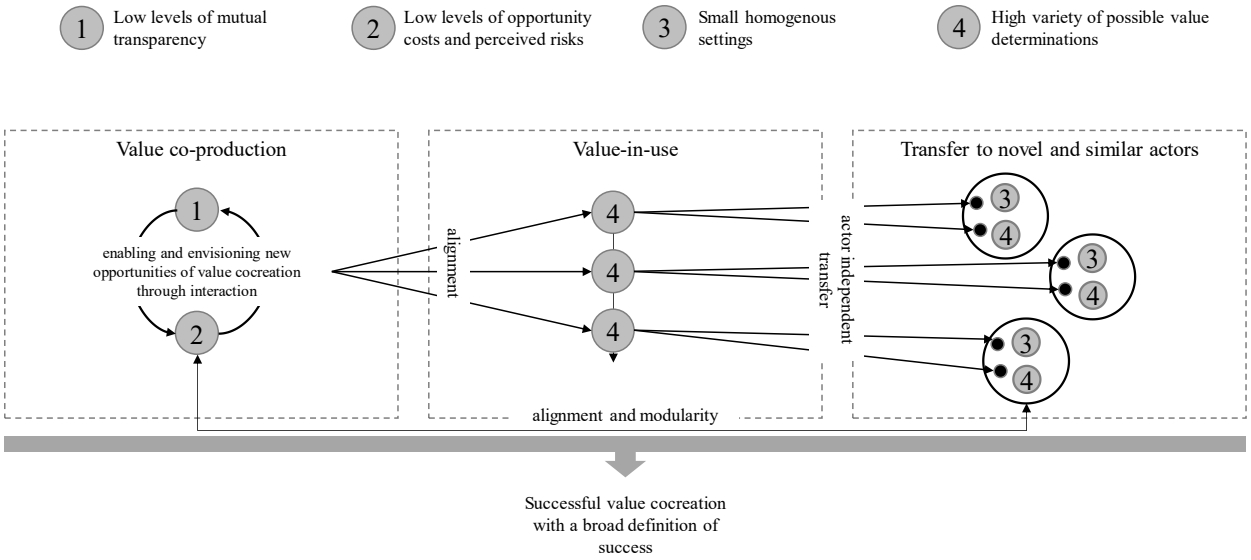

Figure 5-1 Conception of contextual VCC in BoP

Western Market Mode—Conversely, we further find that in contexts with high levels of mutual transparency, high opportunity costs and perceived risks, relatively high homogenous settings, and low variety of possible value determinations have impacts on the process of value co-creation as well. The identified process elements are similarly illustrated in Figure 5-2. First, the contexts that are defined by factors described at the beginning of this paragraph only show a limited potential for co-production compared to the BoP-

mode. The high level of transparency paired with opportunity costs and perceived risks impede the need and potential for co-production. This low limited space for co-production later on further impedes the recombinatory transfer to novel and similar contexts but favor a direct and broadcast-like transfer. Second, the same holds true for the impact of the low variety of possible value determinations, which only allows for a limited number of possible value paths (depicted with a single arrow in Figure 5-2). Subsequently, the transfer is also *actor dependent*. The original actor (e.g., the offering firm) is in charge of the transfer to other actors in novel and similar contexts through a process of *duplication*. Consequently, this process where value co-creation is mostly limited through value-in-use, is less alignment intensive and built on less modules and interfaces.

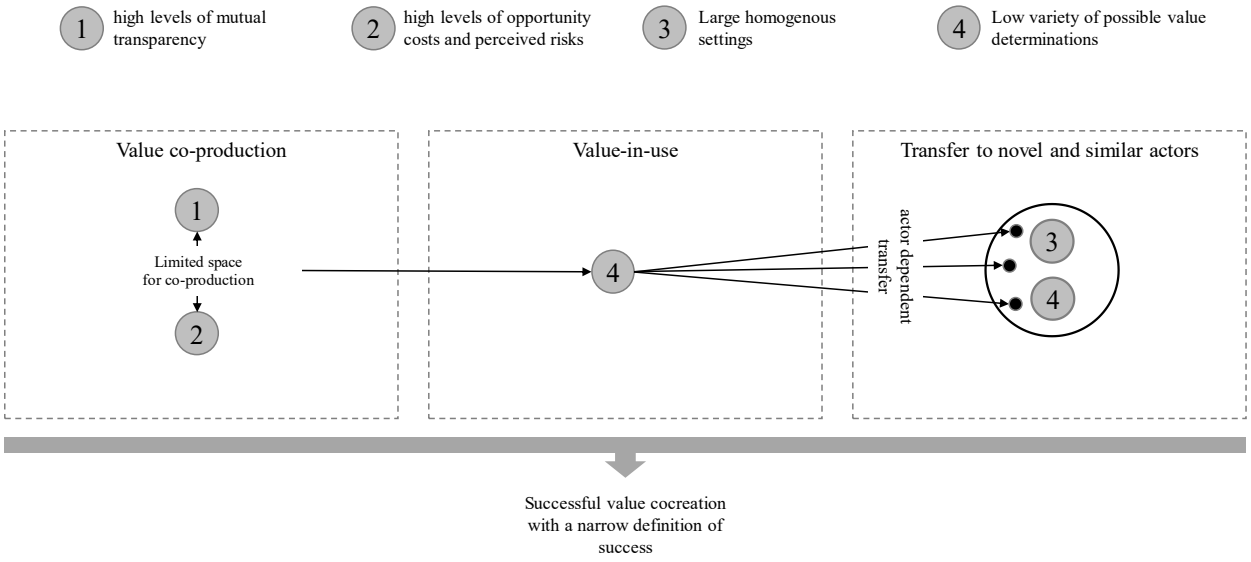

Figure 5-2 Conception of contextual VCC in Western Markets

5.6. DISCUSSION AND CONTRIBUTIONS

Our findings present interesting extensions to the current understanding of the contextual nature of VCC processes and offers worthwhile directions for future research.

First, we empirically confirm (in the case of transparency, value determination, small homogenous settings) and extend (in the case of opportunity costs and risk) the understanding of contextual impact factors on value co-creation. In particular, the introduction of risk and opportunity costs is yet to be included into the theory on value co-creation. Value co-creation is massively interactive and collaborative in nature (Akaka et al., 2013; Kohtamäki & Rajala, 2016) and moves from a dyadic to networked relationships of value creation (Lusch & Vargo, 2014; Vargo & Lusch, 2017) where all actors have active roles (Lusch & Vargo, 2014; Rice, 2002; Storbacka et al., 2016). By implication, all actors need to actively decide to play an active role or not. The decisions of these

actors play a crucial role in practice. Including the already identified strong negative relationship between risk perception and opportunity evaluation (Keh, Foo, & Lim, 2002), exchange symmetries (Kahnemann, Knetsch, & Thaler, 1990), and perspectives on value co-destruction (Anne Smith, 2013) can help to draw a more concrete and complete picture of value co-creation.

Second, we extend the understanding of the value co-creation process and incorporate the transfer and scaling of value propositions. The latest comprehensive conception of the value co-creation process identifies value co-production and value-in-use (Ranjan & Read, 2016) as two successive elements. After that, a steady-state of value co-creation is assumed and the transfer and scaling are not in the picture. While this narrow focus makes sense of value co-creation in the beginning, it clashes with the reality of economic actors. In reality, economic actors' primary objective is to grow their own offerings (Bhardwaj, Camillus, & Hounshell, 2006; Penrose, 1996; Raisch & von Krogh, 2007). We bring that view back into the picture and find the actor independent transfer and scaling to be essential in the described context. This is to some extent in line with some earlier findings, which posit that the whole process in BoP contexts is a co-integration of complementary assets (Nahi, 2016b). However Nahi puts the scaling on the side of the initial offering actor (2016b) and thus conflicts with other findings that emphasize the entrepreneurial attitude of all actors (Dembek et al., 2018; Gebauer et al., 2017; Knuckles, 2016). We also observed this entrepreneurial attitude of the involved actors and found that a deep interaction in the phase of value co-production enables a broad transfer in the later stage. The identified structural differences in the identified scaling processes furthermore strongly echo the different structures of diffusion. The identified diffusion in BoP contexts shows strong links to the structures of virality (Goel, Anderson, Hofman, & Watts, 2015).

Third, the iterative and more networked process of value co-creation in BoP markets favors non-linear market structures (Knuckles, 2016). Typically, value chains in BoP markets are not just hierarchical or integrated (i.e., vertically integrated), but networked by including a variety of small actors in the process. However, value networks are more complex to manage (Laamanen, Pfeffer, Rong, & de Ven, 2016; Möller & Halinen, 1999) and rely on intensive coordination mechanisms (Hellström, Tsvetkova, Gustafsson, & Wikström, 2015; Kapoor & Agarwal, 2017). Literature and other studies [see Chapter 4] tell us that in these cases centralized (market) coordinating structures and institutions evolve (Constantinides et al., 2018; Helfat & Raubitschek, 2018; Vargo & Lusch, 2017).

However, who and how that role is taken can only be guessed at the moment and explains the networked process observed in this study.

Ultimately, we combine these elements and advance the understanding of context-dependent value co-creation processes in the specified contexts by connecting previously independent elements. We thus arrive at a preliminary staging or life-cycle view on value co-creation and meet the calls for the development of process frameworks for value co-creation (Polese et al., 2017; Ramaswamy & Ozcan, 2018; Reypens et al., 2014). The proposed process framework makes several important connections. For one, aligning the value co-production phase with value-in-use and transfer phase is necessary for both a wide adoption through a variety of value determinations. And the alignment allows for a wider entrepreneurial audience to be acting as transferring actors. This alignment is well in line with the interactional focus of value co-creation, where scaling not only focuses on novel actor constellations, but aligns these with the specific interactional value for each actor (Ramaswamy & Ozcan, 2018) and the calls for a carefully orchestrated process (Frow et al., 2015).

5.7. FUTURE RESEARCH

We believe that this study offers several exciting paths for future research. First, the holistic process view of VCC in varying contexts could be further refined and empirically tested. Understanding the relative importance—that is, the marginal value contribution—of each step can be of great help for managers and researchers alike. Second, we find that transparency in this polar context has a significant influence, however, we cannot yet examine the exact mechanisms how potential grades of lower or higher transparency interact with the value co-creation process. Is the influence continual or bimodal? Third, looking into the different diffusion structures of broadcasting or virality can lead to exciting new insights. As Goel et al. (2015) find, many of the studied examples of viral diffusion structures include a shareable element. It could be interesting to understand what these shareable elements in physical products are and how the process of value co-creation promotes or hinders their establishment and usability.

6. CONCLUSION

6.1. OVERALL SUMMARY

The thesis investigates how firms and other actors can manage value co-creation through interaction, alignment, and resources orchestration in varying contexts. Drawing on business model innovation, resource orchestration, international business, and service-dominant logic literature, this thesis provides empirical evidence of the phenomenon of value co-creation and establishes foundations for future systematic research. Overall, empirical research of value co-creation driven by the phenomenon itself is still in an early stage. Thus, with its exploratory character, this thesis contributes to a better understanding of the phenomenon. It shows the touchpoints to adjacent literature streams and thus introduces new theoretical lenses to study the phenomenon. In terms of its composition, this thesis studies the following aspects of value co-creation: Chapter three studies the use of business models as categorical instruments to disentangle and analyze systems of value co-creation and elaborates its practical implications. Chapter four investigates how resources can be orchestrated across firm boundaries for value co-creation through the interaction of organizations and interaction of resources. Chapter five studies varying mechanisms of value co-creation through an in-depth study of value co-creation processes in a polar empirical setting.

Based on an exploratory research approach, this thesis provides valuable insights for management practice and future research on the management of value co-creation.

6.2. IMPLICATIONS FOR LITERATURE AND FUTURE RESEARCH OPPORTUNITIES

With respect to the academic literature, the third chapter is one of the first attempts to use business models as a categorization criterion for strategic groups or archetypes. It examines the characteristics of each firm's business model. This contribution is of interest given the increasing dominance of the business model as a unit of analysis (Zott et al., 2011), but especially because it introduces a mid-level model for the discussion of categories. However, vast research opportunities subsequently emerge at the interplay of value co-creation and research on categories (also see Cattani, Porac & Thomas, 2017).

First, value co-creation highlights the different levels of value creation and their interplay—from the individual actor perspective to shared institutionalized logics. Thus, drawing categorical circles around value co-creation logically calls for a multi-level perspective. The use of business models can be one starting point as illustrated in Chapter 1.

However, to fully account for the phenomenon, an even more open model needs to be established. Starting from the business model perspective, higher- and lower-level categories such as systems, institutional logics, and the individual actor need to be incorporated. Additionally, a more comprehensive multi-level perspective needs to account for the interdependent nature of value co-creation. In a world defined by interdependence and complexity, the tools and models to draw categorial lines needs a fresh look. The value co-creation perspective offers promising avenues to achieve this.

Second, as firm-level categorical representations influence strategic choices that are based on real-time transactions, a fundamental theoretical question of categories is that of their durability. This is especially the case in many empirical examples of value co-creation, where the role of actors can be oscillating. How can categories and categorical representations account for real-time change? How can dynamic models of value co-creation account for this challenge?

Finally, as a further basis for categorizing value co-creation, categoric labels need to be established both in research and management practice. It can hardly consist of the conceptual-theoretical nomenclature of the SD-logic with its, at times, nonpractical use of words (e.g., operant vs. operand resources).

The fourth chapter opens up new views on resources, their basis for competitive advantage, and their management. It introduces the view of resource orchestration across firm boundaries and finds mechanisms for its management. Specifically, it opens up the questions of how resourceness or competitive advantage of resources is established in post-possession economies (Rifkin, 2000, 2012). In my point of view, several interesting research streams can originate from here.

First, in Chapter 4 the notion of the value of resources based on their relationship to other resources is established. This can be viewed as a refinement of the resource-based view, as it provides an additional analytical framework to analyze the value, rarity, imitability and non-substitutionality of resources. At the same time, it can be viewed as an extension or divergence from this view as the analytical focus does not lie on a single independent resource, but on the interconnection with other resources. Further research revitalizing the focus of resource-based views with a view of interdependency and value co-creation could thus be promising.

Second, the conceptualization of resources' material properties as governance mechanisms opens up research opportunities on the active and strategic role of resources in research on competition, cooperation and platforms. In this, the interlink between product design, firm strategy and complementor decisions becomes ever more apparent.

Chapter 5 empirically examines context factors that influence the process of value co-creation. By doing so, the chapter closes a crucial gap in the literature. While the current state of literature unanimously posits the context-dependency of value co-creation, conceptional or empirical knowledge on this topic is missing to date. Hence, the subsequent presented processes of value co-creation for varying contexts are a valuable addition to the literature and present another avenue for further research.

First, the proposed end-to-end process view of VCC in varying contexts could be further refined and further empirically tested. In particular, understanding the relative importance—that is, the marginal value contribution—of each step in the process can be of great help for managers and researchers alike. For example, how long should the iterative phase of "enabling and envisioning new opportunities of value co-creation through interaction" last? Furthermore, the impact of the interfaces or relationships among the steps should be part of further evaluations.

Second, our empirical data shows that transparency in this polar context has a significant influence, however the mechanisms of lower or higher transparency are not uniform. Hence, the question of transparency's impact on the value co-creation process could be further studied, e.g., is the influence rather continual or bi-modal?

Third, looking into the different diffusion structures of broadcasting or virality can lead to exciting new insights. As Goel et al. (2015) find, many of the studied examples of viral diffusion structures include a shareable element. It would be interesting to understand what these shareable elements in physical products are and how the process of value co-creation promotes or hinders their establishment and usability. This can be also studied in conjunction with the previously raised questions around resource orchestration. It could especially inform the growing interest into closed or circular systems of value creation.

6.3. IMPLICATIONS ON MANAGEMENT PRACTICE

Also for management practice all chapters offer important implications. In Chapter 3, the results offer an important overview of business model-based strategic groups in the electrical power sector across different regions. Categorizing the firms in the industry into strategic groups makes understanding the competitive landscape easier and less complex. The increasingly dynamic and uncertain nature of the electrical power sector renders this effect especially beneficial, as complexity reduction is particularly valuable when managers suffer from information overload. In addition to supporting managers in better understanding the current competitive landscape, the overview of existing business models and their strategic dimensions in the electrical power sector can also stimulate their ef-

forts to innovate their business models. As industry transitions typically stimulate firms' willingness to rethink their value creation models, managers need to understand how likely firms from other strategic groups are to contest the territory of the managers' own ground and the attractiveness of other strategic groups to enter for their own firms. Overcoming the dominant logic of the firm is a key success factor for business model innovation. As the business models we have identified can be used as an input to identify opportunities, our study can be of great help for decision-makers and innovation managers in their business model innovation endeavors.

In Chapter 4, the study informs managers about decisions and needed capabilities if they are confronted with creating value from orchestrating resources across many actors.

First, it indicates that managers need to understand the value-creating potential of different levels of digitally enabled resource relationships to decide which way resource orchestration should be handled. Further, they should consider to what extent they are capable and willing to interact with other actors or what is their and their counterparts' capabilities in direct digital enabled resources. For instance, a high degree of resource interaction requires more trust and mutual learning in the early phase, while a high interaction of organizations requires the respective organization to be able to carry out a high degree of coordination and communication.

Since the chapter also illustrates that the interaction of resources and the interaction of actors is to some extent equifinal, managers do not necessarily need to pursue high levels of both interaction types if they want to advance resource integration—however they need to actively address this tension. The chapter will remind managers that a mere focus on resources in their present form is likely to be short-sighted if they want to make the most of the potential value or orchestration resources across many actors. Rather, promising new opportunities for value co-creation emerge if resources are modified accordingly. Further, this study presents interesting insights for managers specifically in the electrical power sector.

As introduced (see Chapter 1), the electrical power sector will see a wave of digitization in the coming years. One central aspect will be the management or orchestration of distributed energy sources. For this, digitalization plays a key role to increase reach, efficiency, and, ultimately, value creation. The study notes that actors in the sector should understand on which level (resource or organization) digitally enabled relationships should be formed to create superior value. An interesting case presents the current discussion on distributed ledger technologies. Distributed ledger technologies can be applied at both ends, the resource side and the organization side. However, the value that would be co-created differs vastly. Establishing value creating relationships on the resource lev-

el focuses on the transaction itself: make it efficient, create hyper-customized energy mixes, and create an automated self-organized system. On the contrary, focus on the organizational level creates value around security, relationships, and co-innovation. This clear categorization can help managers to prioritize and find the right focus of their efforts and investments.

Moreover, in the context of the electrical power sector, the results of this study indicate the likelihood of multiple or ambidextrous platforms. In a sector that generally operates under regulated or thin margins, efficiency is one central aspect. Additionally, at the core, the physical limits (especially low levels of electricity storage in worldwide energy systems), calls for high reliability of energy sources. Correspondingly, the findings of Chapter 4 favors platforms that are driven by high digitally-automated interactions between resources and at the *same* time platforms that organize interactions on an organizational level. One current example, the Brooklyn Grid (Mengelkamp et al., 2018), begins to take such an approach (contractionary to its marketing). Naturally, platforms based on high interaction of resources will profit from network effects and economies of scale and thus favor a winner-takes-all market. This means, that most likely, in the long-run one platform per regulatory framework will be the winner. However, platforms based on interaction of organizations do not show such strong network effects (based on direct linear correlation between costs and number of relationships) and hence favor the existence of multiple (e.g., regional) platforms. For managers in the energy sector who invest into building platforms, this distinction is vital because it illustrates the mechanisms of success and competition.

Next, the findings show that the idea of "peer-to-peer" in electricity markets needs important distinctions. Currently, there are several ongoing peer-to-peer energy projects. To name some examples: Piclo in the UK, Vandrebron in the Netherlands, PeerEnergy Cloud, Smart Watts Lichtblick Swarm in Germany, Community First! in Texas amongst others (Zhang, Wu, Long, & Cheng, 2017). However, the value creation mechanisms in these projects are rather ambiguous. Chapter 4 suggests that to define peer-to-peer energy trading platforms, the *level of value creating relationship*, the *value* that is aimed to create and the *means* (e.g., efficiency, automation, actor connection) to achieve them can serve as defining criteria. This increased accuracy could help to disentangle some of the ambiguities that still exist in the concept of peer-to-peer energy trading (Morstyn et al., 2018; Morstyn & McCulloch, 2018; Zhang et al., 2017). For managers in the sector, this conceptual accuracy can help to understand and communicate in which markets one wants to succeed, and the needed capabilities.

Adding to this and combining the insights of Chapters 3 and 4, managers need new categorial tools to manage resources for value co-creation. For example, building prosumer models using classical models and tools such as RBV's VRIN, Porter's five forces, or the SWOT analysis will most likely end with shortcomings as these tools do not fully comprehend the mechanisms at play. This thesis offers new analytical tools and mental models to be used in management practice.

Lastly, the study of context depending value co-creation processes (Chapter 5) yields insights for managers in the electrical power sector.

On the one hand, there are several instances where managers from the Western electrical power sector can learn and profit from applying the identified BoP-mode process of value co-creation. First, the identified higher variety of possible value determinations that is induced by high levels of co-production (see Figure 5-1) could be an interesting starting point for Western markets. As the energy trilemma already points out, at least three potential value determinations—that is, energy efficiency, energy equity, and environmental sustainability—are in play in the energy sector. The process of value co-creation identified in BoP in Chapter 5 is more suitable to integrate these value determinations than the Western market process. Further, the openness for additional value determinations could help broaden the idea of value in the context of electricity. Electricity is not an end in itself. A solar lantern that simultaneously charges a cellphone is a good example of a product whose primary value definition—a source of kerosene-free light—was broadened to serve an additional need. Further, value co-creation is inevitably linked to a strong service perspective (Vargo & Akaka, 2012). Practically, this is demonstrated in BoP contexts with the huge variety of services that mini-grid providers are offered at the same time as the electricity per se: lighting, phone charging, operating a fan, television, or radio, etc. (Bardouille & Muench, 2014; IEA, 2018; World Bank, 2012). Additionally, many current businesses in the electrical power sector act on strong negative externalities (e.g., costs of CO_2 emissions are not adequately accounted for). A value co-creation approach to business models in BoP contexts already showed promising results in including former negative externalities (Dembek et al., 2018).

Moreover, the changing landscape in Western market electrical power sectors shows strong similarities with BoP contexts in terms of the new definition of roles in value creation. Knuckles (2016) for example finds, that "there is no single, well-defined role that a mini-grid developer can play in the mini-grid business model. Instead, the value chain of a mini-grid entails the local community and other 3rd parties as important actors for building, owning, operating, and/or maintaining the mini-grid" (p. 75). Hence, the

BoP process of value co-creation can offer insights to Western managers in the electrical power sector on how to open up to new roles and integrate other actors in the process of joint value creation (including technology as actor). For example, Dey, Pandit, Saren, Bhowmick and Woodruffe-Burton find strong evidence of consumer-to-consumer interaction that contributes to the value creation in BoP (2016a). Firms in these contexts learn how to engage in changing roles and responsibilities. Additionally, technology itself becomes more and more actor-like (Akaka & Vargo, 2014). For example, on the Isle au Haut, a small island off Maine's coast, the entire microgrid will be managed by artificial intelligence. Value creation with technology as such a critical actor seems to have much more in common with the value co-creation process in BoP contexts than in Western markets. Hence, learning from this context could be helpful.

Lastly, due to contextual factors, market sizes for comparable offerings is smaller in BoP markets than in Western markets. However, the bigger re-combinatory power, and possibly stronger diffusion through virality and bigger audience through higher possibility of co-productive processes, enables small actors to create offerings for a wide audience without the necessity to scale it on their own. Comparing this to electrical power system market structures, where, in various countries, several hundreds of utilities exist, the conception of value co-creation in BoP contexts could serve as a blueprint for innovation and value creation. Moreover, recent studies identify risks of non-cooperative behaviors in the context of DERs and micro-grids (Marzband, Javadi, Domínguez-García, & Mirhosseini Moghaddam, 2016; Wang et al., 2017). The findings of Chapter 5 suggest that embedding a BoP-inspired process of value co-creation could mitigate this risk.

6.4. OUTLOOK

The first chapter outlines the increasing importance of the perspective of value co-creation both in research and in management practice and the factors that contributed to this. Most likely, this trend is not coming to a halt. I see several factors in all areas of value co-creation (see Figure 6-1) that make this perspective even more valuable and needed in the future. In general, we will likely see mechanisms that are unorthodox to standard economic and management theories but the perspective of value co-creation qualifies to incorporate and explain them.

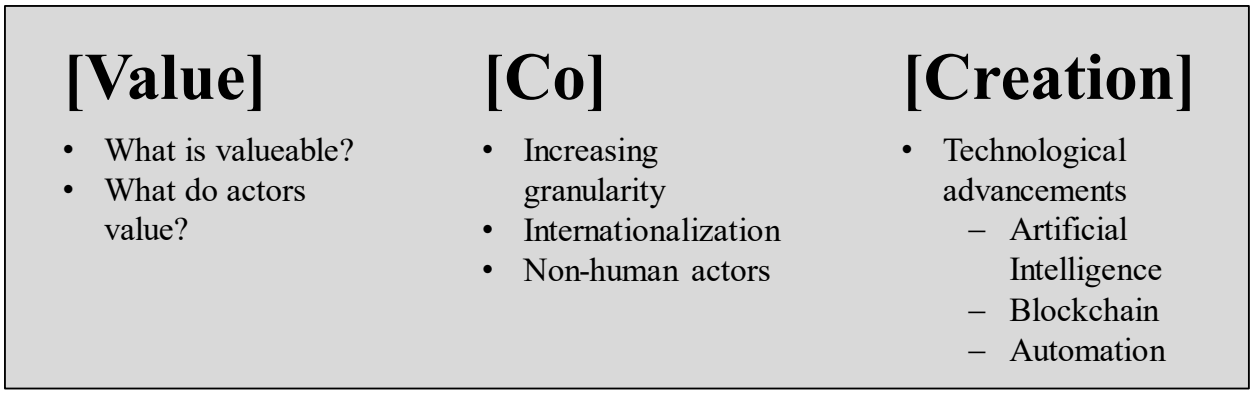

Figure 6-1 Outlook

First, the value co-creation perspective highlights the phenomenological nature of **value** itself. Something becomes valuable because an actor finds value in it. In general, what actors find valuable is becoming more and more individualistic, is subject to continuous change, and the convergence of cyber and physical performance will likely have drastic impacts on what actors define as valuable. With regards to the electrical power sector we will (hopefully) see that sustainable sourcing of electricity will be of higher value. But also, more complex or nuanced forms of value attribution such as premiums for high levels of energy security, personalized energy products, or EV-battery-solar roof-marketplace bundlings such as Tesla's offering will grow in importance. However, this means that the economic actors in the electrical power sector, such as utilities, need to move from their lip service to real customer-centric companies they often proclaim to be. Extracting value from assets will become increasingly difficult and competitive advantage moves toward the value co-creating relationship. Solely due to changing value determinations, the mechanisms of value co-creation are prone to revisions.

Second, the actors involved (**co**) in process of value co-creation are likely to change as well. Examples of the sharing economy or social networks already illustrate that the creation of value can be based on numerous many-to-many relationships. If this trend increases as projected, the nature of value co-creation can further change its face with it also its magnitude. Moreover, the increasing number of smart devices, sensors, algorithms, interactional AI, and robots means that researchers and managers need to rethink who needs to be viewed as an actor in value co-creation. Many of these devices already take the role of an economic actor and will do so in the future. The value co-creation perspective can be tremendously helpful to account for this phenomenon. For the electrical power sector this shift means an even further departure from the centralized value chain. Moreover, the importance of prosumer investments before and beyond the meter become much more critical. Broadly constructed, the majority of future grid investments will

come from the customer, and with that comes coordination and compatibility issues that need to be reconciled.

Third, the **creation** typically refers to a process, actors' activities or decisions of integrating and orchestrating resources, and interaction between actors. New technologies will likely change these mechanics. A prominently discussed example now is blockchain, as it promises to seamlessly enable secure micro-transactions between many users. If this promise holds true, the creation of value can be altered substantially, and many economic and management theories need a rethink. However, also other technologies, when deployed, will have profound impacts. Automated machine-to-machine communication (M2M), general automatization of vast areas of the economy and advances in artificial intelligence (AI) will result in altered value co-creation mechanisms. For example, in the electrical power sector, these technologies will enable prosumers to *seamlessly* operate virtually independent from the grid but also allows grid operators to drive up the efficiency of their operations. Also, the decentralization of renewable energy sources calls for—at least in an interim period—aggregating and integrating activities to provide a reliable supply. Combined with the aforementioned technologies, this mode of "creation" will be an important component of the electrical power sector.

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APPENDIX I: CURRICULUM VITAE

Jonas E. Boehm

Personal information

Date of birth:	October 16th 1988
Place of birth:	Geseke, Germany
Nationality:	Germany

Education

Since 08.2018	Dartmouth College, U.S.A. Visiting Researcher, Thayer School of Engineering
09.2015 - 09.2019	University of St. Gallen (HSG), Switzerland PhD in Business Innovation
09.2013 - 08.2015	University of St. Gallen (HSG), Switzerland Master in Business Innovation & CEMS MiM
08.2014 – 12.2014	Aalto University, Finland Exchange Semester
09.2009 – 08.2015	University of St. Gallen (HSG), Switzerland Bachelor in Business Administration
02.2012 – 07.2012	University of Melbourne, Australia Exchange Semester

Work Experience

09.2017	Founder at bridge17.org
09.2015 - 02.2019	SAP SE PhD Student / Product Innovation Lead
02.2010 - 12.2013	Various internships in Inhouse Consulting (Banking), Banking, and Automotive

APPENDIX II: FURTHER PUBLICATIONS RELATED TO THIS DISSERTATION

Articles

Böhm, J., Bhargava, H., Parker, G. (2019). Product versus Platform Strategies: The Case of Electric Vehicles. *Foundations and Trends in Technology, Information and Operations Management*

Neumann, L., ***Böhm, J.*** & Wecht, C. (2018). Knowledge Transfer in the Context of Frugal Innovation. *International Journal of Technology Transfer and Commercialisation*

Gassmann, O., Palmié, M., ***Böhm, J.*** & Bömelburg, R. (2017). Innovationsmanagement im Energiesektor. In: *EMW : Zeitschrift für Energie, Markt, Wettbewerb*

Books

Gassmann, O., ***Böhm, J***., Palmie, M. (2018). *Smart City: Innovationen für die vernetzte Stadt – Geschäftsmodelle und Management*. Hanser

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Böhm, J., Neumann, L. & Gassmann, O. (2018). The Impact of Context on Value Co-creation: Polar Cases of Energy Companies. In: *Strategic Management Society Special Conference, December 15-18, 2018, Hyderabad, India*.

Neumann, L., ***Böhm, J***., Gassmann, O. (2018). The Strategic Role of Headquarter-Subsidiary Relationships in the Context of Frugal Innovation. *In: Strategic Management Society Special Conference, December 15-18, 2018, Hyderabad, India*

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Böhm, J., Neumann, L. & Gassmann, O. (2017). Resource Integration and Value Co-Creation: Evidence from the Energy Sector. In: *The XXVIII ISPIM Innovation Conference*, June 18-21, 2017, Vienna, Austria.

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Moellers, T., Haldimann, M., Wecht, C., ***Böhm, J***. & Neumann, L. (2017). Evaluating Business Models in Large Firms. In: *The XXVIII ISPIM Innovation Conference, June 18-21, 2017, Vienna, Austria.*