Value Delivery Architecture Modeling

A new systematic approach to business modeling, implemented and tested in the electric mobility domain

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Dipl. Wi.-Ing., MCom Joachim Metzger

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Referent:	Prof. Dr. Orestis Terzidis
Korreferent:	Prof. Dr. Andreas Oberweis

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List of Abbreviations

AMJ	Academy of Management Journal
BMI	Business Model Innovation
BMWi	Bundesministerium für Wirtschaft und Energie
B2B	Business-to-business
B2C	Business-to-consumer
CS	Charging Station
CCS	Combined Charging System
CPO	Charge Point Operator
DSR	Design Science Research
DSRP	Design Science Research Process
EMP	Electric Mobility Provider
EV	Electric Vehicle
ICE	Internal Combustion Engine
IT	Information Technologies
Mgmt	Management
NABC	Needs-Approach-Benefits/Costs-Competition
NPE	Nationale Plattform Elektromobilität
NTV	New Technology Ventures
QDA	Qualitative Data Analysis
SME	Small and medium-sized enterprises
SMM	Structured Metrics Metamodel
VDAM	Value Delivery Architecture Modeling
VDML	Value Delivery Modeling Language
VPED	Value Proposition Exchange Diagram

1 Introduction

This dissertation introduces a new approach to business modeling with a focus on the integration into the value network. This approach creates transparency about the current status of the value network and offers opportunities to analyze aspects that are relevant for more informed decisions on if and how to implement business model ideas. Additionally, consistent modeling facilitates the subsequent operationalization of these ideas. The new approach enables visualizing and analyzing of new ideas on how to redesign the value network. The motivation for this dissertation is the current situation of the electric mobility domain in Germany. As Chapter 1.1 introduces, this is an industry with significant importance for the future of individual mobility. The lack of a well- established value network, different and incompatible technological standards, and challenges for profitable business models are characteristics of this domain. This especially holds true for the installation and operations of fast charging infrastructure. Based on this real-world problem, the research scope and the guiding research questions of this dissertation will be introduced (see Chapter 1.2). Furthermore, the overall research strategy of design science research will be discussed, including the research methods applied in this work (see Chapter 1.3). This chapter, which is dedicated to the motivation of this work, is concluded with the structure of the work and its contribution (see Chapter 1.4).

1.1 Current situation in the electric mobility domain

Climate change is one of today's key challenges. In the 2015 United Nations Conference on Climate Change in Paris, 196 countries agreed on its reduction. The common key goal is to limit global warming to 2 degrees Celsius above pre-industrial levels. A first crucial step towards this target is to reach the peak of greenhouse gas emissions as soon as possible (United Nations, 2015). By the beginning of 2017, 127 of the conference's attendees ratified the Paris Agreement (United Nations, 2017). This agreement is another step to fight climate change, which has a significant impact on the automotive industry. In 2007, the Intergovernmental Panel on Climate Change had already concluded that passenger transport accumulates to approximately 20% of the global energy consumption, primarily based on fossil fuels. This percentage is expected to raise (Intergovernmental Panel on Climate Change, 2007), leading to the automotive industry's participation in reducing greenhouse gas emissions.

Electric vehicles (EV) gained renewed attention as one innovative technology that can contribute to reducing greenhouse gas emissions in the transport sector. Additionally, it helps to lower local emissions (Plötz, Schneider, Globisch & Dütschke, 2014), making electric mobility a cornerstone for sustainable transportation with the potential to replace fossil fuels (Nationale Plattform Elektromobilität, 2016).

Current data on mobility behavior already states that most of today's trips that are taken with internal combustion engines (ICE) cars could be conducted with EVs available in the market if charging at home or at work is possible (Babrowski, Heinrichs, Jochem, & Fichtner, 2014). While electric mobility is just one of the opportunities to reduce the carbon dioxide emissions, it is deemed the hope for what Schwedes et al. (2013) refer to as a technofix for the climate change problem. A technofix is a technological innovation that makes the need for behavioral changes obsolete (Schwedes, Kettner, & Tiedtke, 2013). Still, this technofix faces some considerable challenges such as expensive batteries, long charging times and limited electrical driving range. These challenges are hindering the market penetration of electric mobility (Bundesregierung, 2009).

While the technofix electrification of road transport has the potential to address many sustainability challenges (e.g. Pietzcker et al., 2014), it is one of the greatest transformations towards sustainability (Capros, Tasios, De Vita, Mantzos, & Paroussos, 2012; McCollum, Krey, Kolp, Nagai, & Riahi, 2014). Assessing the potential and challenges involved, government in many countries have started to introduce public action. Thereby, government is primarily motivated by the fact that electric mobility is advantageous to the community but increases the cost for users. Hence, public action focusses on the availability of electric vehicles (the supply side) and affordability for the user (the demand side) (Leurent & Windisch, 2011). In this context, the German Bundesregierung introduced the 'Nationalen Entwicklungsplan Elektromobilität' with the overall goals to transform Germany into the leading market for electric mobility and to establish the German industry as the leading supplier of electric mobility solutions (Bundesregierung, 2009). Besides supporting this new domain with billions of Euros for research and development, buying incentives, and investment partnerships, the German government is creating a legal framework to establish legal certainty for companies active in the new domain (Nationale Plattform Elektromobilität, 2014).

The study of Proff and Kilian (2012) identifies electric mobility as the key to the creation of value add and job-creation in the European automotive industry. With an accelerated path towards electric mobility, value add of 20 billion Euro could be reached by 2020 and up to 150,000 jobs could be created. A slow path towards electric mobility, on the other hand, could lead to a minus of 20 billion Euro and could put up to 250,000 jobs in the automotive industry of Europe at risk (Proff & Kilian, 2012). Electric mobility is not only an automotive topic, but affects many other industries as well, such as: energy, battery suppliers, infrastructure providers, and mobility service providers. Their relationships and dependencies are highly complex, and a successful implementation can only be reached by collaboration across industry domains (Eschenbaecher, Seifert, & Thoben, 2009; Eschenbaecher, Wiesner, & Thoben, 2014). Hence, new business models with regards to the dissolving industry barriers are expected to emerge. They facilitate opportunities for the success of electric mobility (Bundesregierung, 2009; Nationale Plattform Elektromobilität, 2016).

Among the challenges of electric mobility, the electric range of vehicles and infrastructure availability are of particular significance. One of the key problems for the adoption of electric mobility is range anxiety, meaning that (potential) EV users fear the limited range of electric vehicles. This concern is deepened by the insufficient availability of charging infrastructure (Birrell, McGordon, & Jennings, 2014; Dütschke et al., 2012; T. Franke & Krems, 2013; T. Franke, Rauh, Günther, Trantow, & Krems, 2016; Luettringhaus & Nilsson, 2012). Publically accessible fast charging infrastructure is an appropriate way to address this range anxiety and a quick installation of fast charging infrastructure is deemed critical (Nationale Plattform Elektromobilität, 2014; Nationale Plattform Elektromobilität AG 3, 2015). Fast charging stations with up to 100kW direct current enable an 80% recharge of a battery within 20 minutes, making it almost comparable to refueling ICE vehicles (Qian, Zhou, & Yuan, 2015; Schroeder & Traber, 2012). Accordingly, German government postulated the need of 7.100 fast charging points to create a nationwide coverage with adequate availability for EV users in 2020 (Nationale Plattform Elektromobilität AG 3, 2015).

However, a nationwide coverage seems to be a challenging goal to reach. At the end of 2016, only about 150 fast charging points were installed in Germany (Nationale Plattform Elektromobilität, 2016). In 2012, the Nationale Plattform Elektromobiltät stated that the installation of infrastructure is economically not feasible (Elektromobilität, 2012). The so-called chicken and egg problem of electric mobility is that charging infrastructure and EV sales mutually influence each other: as long as there is a limited number of EVs in the market, a viable business case for the installation and operation of fast charging infrastructure is not possible. Limited availability of infrastructure makes the purchase of EVs unattractive for potential users (Hardinghaus, Blümel, & Seidel, 2016; Meister, 2010; Nationale Plattform Elektromobilität, 2014). This challenging situation is complicated further by the fact that severe investments are necessary to install a chargepoint. The initial investment is about 30.000 € per chargepoint. This amount does not even consider additional cost for local electrical grid requirements. On top of that, the operation of fast charging infrastructure costs about 3.000 € per annum (Jochem, Brendel, Reuter-Oppermann, Fichtner, & Nickel, 2016; Nationale Plattform Elektromobilität, 2014). Combined with a sufficient AC- charging infrastructure, a total investment of more than 500 Mio. € is required to reach the charging infrastructure goals postulated for 2020 (Nationale Plattform Elektromobilität, 2016). The German government is attempting to address this situation twofold: high subsidies for the installation of fast charging infrastructure of up to 50% of the investment costs are granted, e.g. in the project SLAM[1]. On the other hand, as part of government funded projects, sustainable business models are being added to the research agenda (ika – Institut für Kraftfahrzeuge, 2014; Nationale Plattform Elektromobilität, 2014).

New business models in the domain of electric mobility, including those for the installation and operation of fast charging infrastructure, have been one of the greatest challenges (Nationale Plattform

[1] SLAM (Schnellladenetz für Achsen und Metropolen): http://www.slam-projekt.de/index.php

Elektromobilität, 2014; Reinke, 2014). Results of accompanying scientific research of government funded projects that are focusing on business models for the installation and operations of charging infrastructure are not yet published (Brost, Funke, & Vallée, 2016). However, other researchers are addressing the business model topic for the domain of electric mobility. An example of this is the work by Eschenbaecher et al. (2014). It introduces the perspective of extended product concepts to the electric mobility domain. In this context, extended products are characterized by core products accompanied by tangible and intangible assets (Thoben, Eschenbaecher, & Jagdev, 2001). In their case study focusing on car-sharing services in the context of electric mobility, Eschenbaecher et al. (2014) show how the extended product concept and the Business Model Canvas by Osterwalder and Pigneur (2010) can be combined to analyze business models in the domain of electric mobility. They argue that this approach can be used to analyze collaborative efforts and that it displays the inter-linkages between various stakeholders and companies in the electric mobility domain (Eschenbaecher et al., 2014). While it is a promising step towards the modeling of new business models, I argue that one important aspect is missing: the description and depiction of the full value creation network of the domain. This is necessary due to the fact that complex value creation across industry boundaries often challenges today's business models. Electric mobility, specifically fast charging infrastructure, is missing an established value network, as well as viable business models for installation and operations, further complicating the situation. This creates the need for new approaches to business modeling (Metzger, Kraemer, & Terzidis, 2016; Metzger, Terzidis, & Kraemer, 2015).

The motivation for this dissertation was a research project in the context of electric mobility in Germany. The goal of this research project was to analyze, evaluate, and redesign the business model for fast charging stations. Experts agree that the business case for the fast charging station is not profitable if only based on selling electricity or charging time and that there is no viable business model for the infrastructure alone (Metzger et al., 2015). The situation is a key hurdle for the broader adoption of electric mobility: if not enough parties are willing to invest in fast charging stations, realizing sufficient reach and ad-hoc mobility is not possible. This, in turn, will be slowing down the adoption of electric vehicles (Nationale Plattform Elektromobilität, 2014). Therefore, the search for an adequate business model has been one of the biggest challenges for the last couple of years (Nationale Plattform Elektromobilität, 2014; Reinke, 2014). Applying mainstream methods such as the Business Model Canvas by Osterwalder and Pigneur (2010) is feasible (Eschenbaecher et al., 2014), but does not establish a clear picture of the value creation network. The complexity of value creation, uncertainty in the domain, and the lack of an established value network with a viable business case are substantial challenges for the domain. Hence, a new approach to responding to these difficulties is required. This approach needs to enable market participants, government, researchers, and potential market entrants to understand the value creation network and should support the successful positioning of a company within this network (Metzger et al., 2016). This research project is introducing Value Delivery Architecture Modeling (VDAM), a new approach to business modeling that facilitates

analyzing, evaluating and designing business models and their embeddedness in the value creation network. This approach is instantiated in the domain of fast charging infrastructure in Germany.

1.2 Research scope and guiding research questions

This dissertation is allocated in the area of management studies and entrepreneurship studies with the central purpose to develop, instantiate and validate a new, structured approach for business modeling. Instantiation and validation are conducted in the area of fast charging infrastructure in Germany. In this subchapter, the scope of the project, as well as the guiding research questions that include the research gap, are presented. Additionally, the comprehensive research strategy of this dissertation and the research methods applied are introduced.

According to Edmondson and McManus (2007), it is important to consider the methodological fit in management field research to ensure quality research in an effective way. Methodological fit refers to consistency among elements in the research project. Thus, Edmondson and McManus (2007) define three archetypes of methodological fit, which are determined by the state of prior theory and research in the field, namely nascent, intermediate, and mature. A prominent example is the fit between the used data types for research projects (qualitative, quantitative, or hybrid) and the different states of prior theory and research (see Figure 1). Other elements that should be considered for the internal fit are research questions, previous work, research design, and theoretical contributions (Edmondson & McManus, 2007).

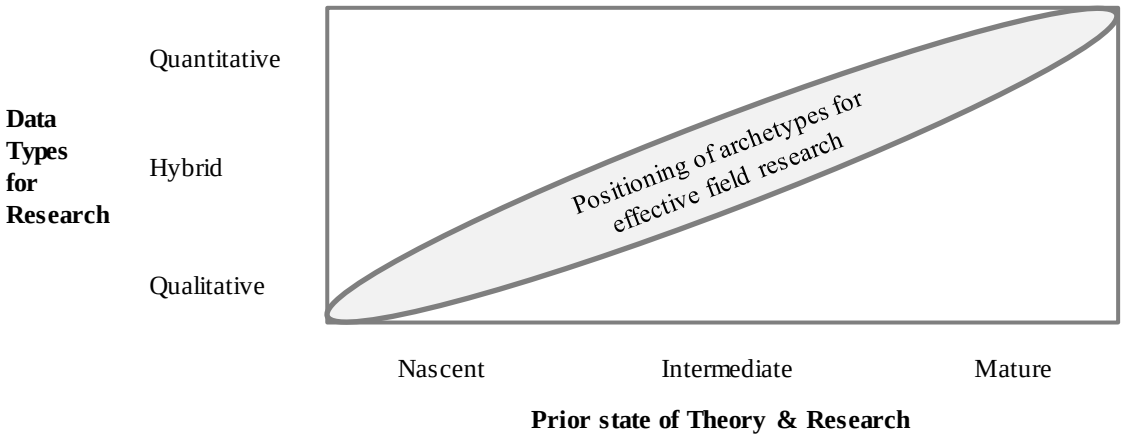


Figure 1 - Methodological fit between data and theory (Edmondson and McManus, 2007)

Looking at the consistency between data and the prior state of theory in a field, the diagonal displays effective field research in management studies. For example, research projects in an area with a nascent theory are well advised to focus on qualitative data to ensure effective field research. In fields with mature theory, quantitative data can be of high value for effective field research (Edmondson & McManus, 2007).

Nonetheless, divergence from these archetypes can be valuable to science as well: e.g. to use qualitative data to suggest a new theory and enable future discussion in an area, as Perlow, 1999, did in his work on the sociology of time (Edmondson & McManus, 2007; Perlow, 1999). On the other hand, it might include risks, e.g. finding significance by chance when applying quantitative research methods in fields with nascent theory (Edmondson & McManus, 2007; Rosenthal & Rosnow, 1975). Therefore, researchers should make informed decisions on the type of data used in the research project to avoid pitfalls that lead to extra efforts in analysis or even a re-start of the research project. The same holds true for the other elements that contribute to the methodological fit.

Within this research project, methodical fit is considered in every step. While the topic of business modeling has become much more prominent in the last two decades, some fundamental ambiguity amongst researchers still exists. Therefore, the state of prior theory and research in the sense of Edmondson and McManus (2007) should be considered intermediate at the most (see Chapter 2.2.1). The central purpose of this dissertation is to develop, instantiate and validate a new structured approach to business modeling. I argue that this new approach is necessary because emerging industries and the business models within are growing increasingly complex and established business model approaches do not conquer these challenges exhaustively. This is especially true with regards to the topic embeddedness in the supply network (see Chapter 2.2.3).

As stated above, the domain of fast charging infrastructure is a good example for emerging industries (see Chapter 1.1). The field of fast charging infrastructure is characterized by 1) the lack of an established value chain and 2) participating companies from different industries with different perspectives on the topic that need to cooperate for the first time. The lack of a positive business case for the operations of fast charging infrastructure based on the sale of energy additionally impairs this difficult situation (see Chapter 3.4). This leads to the need for a new perspective on potential business models in the area of fast charging infrastructure.

The following three research questions guide this research project:

1) *What differing meta-models for the description of business models exist and how can they be applied in the domain of fast charging infrastructure?*
2) *How can complex value streams in the domain of fast charging infrastructure be displayed and what potentials exist?*
3) *How can a meta-model improve the development of innovative business models and support the enhancement of their operationalization?*

To answer these questions an explorative design science research project based on qualitative and quantitative research methods has been conducted. The findings of this research project contribute to

existing theory in two ways: First, the instantiation in the new domain of fast charging infrastructure leads to a more in-depth understanding of value creation and delivery, thereby enabling opportunities for new business models. Second, the new approach, itself, allows for an enhanced understanding of business modeling in domains, which are characterized by complex value creation, uncertainty, and the lack of an established value network. The following subchapters introduce the fundamental research strategy and the methods applied.

1.3 Research strategy and corresponding methods

This dissertation follows the Design Science approach as a guiding research strategy, with the goal of developing an innovative and purposeful artifact – Value Delivery Architecture Modeling – which addresses the challenges of business modeling in complex and uncertain environments and supports its operationalization. Design Science Research (DSR) originated in engineering (Simon, 1996) and has since been applied in manifold fields of research, including organization and management studies (Hodgkinson & Healey, 2008; Jelinek, Georges, Romme, & Boland, 2008; Van Aken, 2004; Van Aken & Romme, 2009) as well as entrepreneurship studies (Sarasvathy, 2003; Sarasvathy, Dew, Read, & Wiltbank, 2008). The underlying principle of DSR is that knowledge and understanding are gained by developing, applying, and evaluating artifacts (Hevner, March, Park, & Ram, 2004). Thereby four types of artifacts, namely constructs, models, methods, and instantiations are produced (S. T. March & Smith, 1995). DSR seeks to solve so-called wicked problems, which are characterized by unstable requirements and constraints, complex interactions, inherent flexibility to change, and dependence upon human cognitive and social abilities (Hevner et al., 2004).

Following Hevner et al. (2004), Design Science derives its relevance and motivation from problems and potentials of the application environment, e.g. people, organizational systems, and technical systems. Additionally, this application domain represents the validation space in which a developed artifact needs to be tested in order to assess its meaningfulness. On the other hand, design science can build on and use a vast knowledge base. This knowledge base, consisting of scientific theories and methods as well as experience, expertise and existing artifacts, is the foundation of design science efforts. Besides solving problems of the application environment, the goal of design science is to contribute to the knowledge base with innovative results (Hevner, 2007; Hevner et al., 2004). Here, the three key building blocks environment, DSR, and knowledge base are complemented by three cycles (see Figure 2), which were added by Hevner while answering the constructive criticism expressed by Juhani Iivari (Hevner, 2007; Iivari, 2007). The Relevance Cycle connects the environment with DSR while the Rigor Cycle connects DSR with the knowledge base, visualizing the input and feedback loops between these building blocks. The third cycle

is the so-called Design Cycle, representing the iterative process of developing artifacts and evaluating them within DSR (Hevner, 2007).

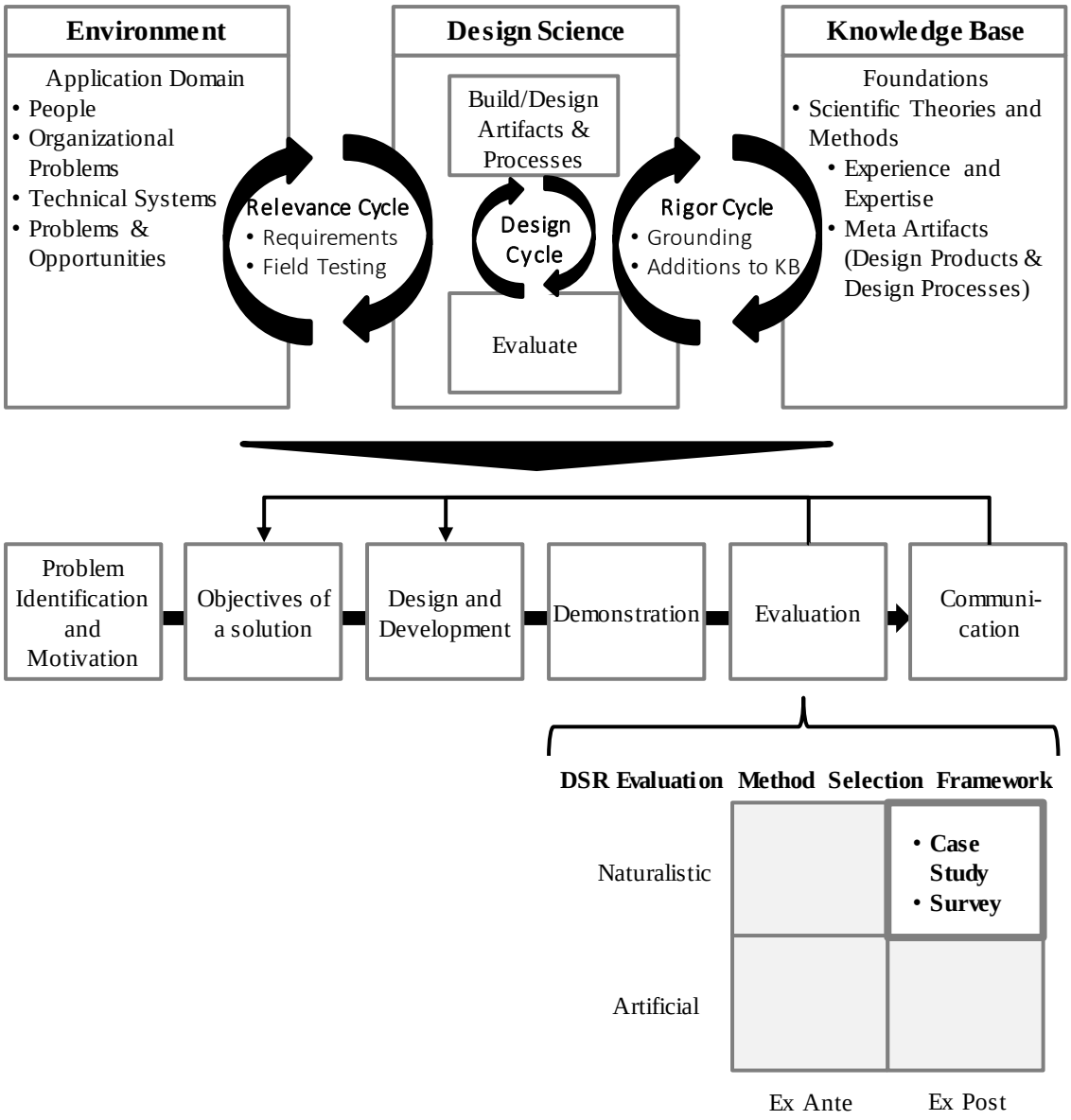


Figure 2 - Applied research strategy, based on Hevner (2007), Peffers (2006), and Venable et al. (2012)

Based on a comprehensive desk research on methodical advancements in DSR, including Hevner et al.'s findings (Hevner et al., 2004), the Design Science Research Process (DSRP) was introduced by Peffers et al. in 2006. DSRP is a general framework that embodies six steps (see Figure 2), synthesizing the findings of the wide-ranged literature review. According to the process, following the problem identification and motivation, the objectives of a solution need to be defined. Based on this design and development of an artifact, demonstration and evaluation are of crucial importance in the process, as well as the professional communication of the problem, its significance, and the resulting artifact itself to the scientific community

(Peffers et al., 2006). Besides the case studies provided in the first paper, Peffers provided further evidence of the meaningfulness of the process in 2007 (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007).

Even though DSRP is modeled in a sequential order, Peffers et al. (2006) conclude that researchers can't be expected to always comply with it, e.g. because an already existing artifact should be applied in another area of expertise and therefore has not been formally thought through for this instantiation. In this case, the research starts with step 3 and will be conducted outward (Peffers et al., 2006). This leniency concerning the sequence of the steps is in the spirit of the application of Hevner et al.'s (2005) DSR guidelines. These seven guidelines ensure and facilitate effective DSR and are derived from the underlying principle mentioned above. They cover topics such as the requirements to develop an innovative purposeful artifact (Guideline 1) which contributes to research (Guideline 4) and is communicated effectively to both researchers and practitioners (Guideline 7). Nonetheless, Hevner et al. (2004) refrain from a mandatory application of these guidelines. Instead, they propose to determine which guidelines are of importance to the particular research project (Hevner et al., 2004).

While there seems to be some leniency concerning the application of guidelines or necessary steps in frameworks, there is a broad agreement about the critical importance of artifact evaluation in Design Science (Hevner et al., 2004; S. T. March & Smith, 1995; Peffers et al., 2006; Van Aken & Romme, 2012, 2009; Venable, Pries-Heje, & Baskerville, 2012). Therefore, Venable et al. (2012) develop a DSR evaluation framework, with the goal to assist researchers in choosing appropriate evaluation methods for the specific conditions of their research projects. The DSR Evaluation Strategy Framework is the basis for this framework (see Figure 2). It consists of two dimensions, distinguishing between ex ante and ex post evaluation as well as artificial and naturalistic evaluation, thereby creating four quadrants (Pries-Heje, Baskerville, & Venable, 2008). Adding characteristics such as resources and goals to the resulting four quadrants allows for a more clear distinction between the resulting strategies and completes the framework. Additionally, the advanced framework suggests appropriate research methods to the four evaluation strategies of which researchers can choose from. Altogether this framework serves the goal to improve efficiency and effectiveness of DSR evaluation in this new field of research (Venable et al., 2012). A naturalistic ex post evaluation is conducted by applying this framework to this dissertation. The methods employed are case studies and associated surveys (see Chapter 6).

Scientists in the field of Information System have been making the most recent conceptual DSR efforts. Nonetheless, researchers in entrepreneurship and management studies have also been applying DSR since the 2000s (Jelinek et al., 2008; Sarasvathy, 2003; Sarasvathy et al., 2008; Van Aken, 2004; Van Aken & Romme, 2009). The distinction between the area of management studies and organization studies is one of the dominating conceptual discourses in the two fields. While organization studies are characterized as explanatory approaches, management studies, on the other hand, are described as design science. The

description-focused explanatory sciences are problem focused with the goal to develop a causal model or quantitative law out of an observation perspective. Prescription-driven research, on the other hand, is solution focused, aiming to produce a tested and scientifically grounded technological rule (aka artifact) out of the perspective of a participant. Even though understanding and explaining are of particular relevance, developing design knowledge which can be used to create solutions to problems is the ultimate mission (Van Aken, 2004). The designed artifact, as general knowledge, can be used in particular contexts by practitioners, applying their considerable expertise in their corresponding field (Van Aken & Romme, 2009). Therefore, design science in management studies aims at addressing improvement problems associated with existing entities as well as construction problems by developing new entities (Denyer, Tranfield, & Van Aken, 2008).

This dissertation applies a design science approach, following the framework and guidelines of Hevner et al. (2004) using it for business modeling. As introduced above, the research framework by Hevner et al. (2004) builds on the understanding that business needs, which are derived from the environment, and the use of an existing knowledge base lead to the development of new theories and artifacts. These theories and artifacts need to be justified and evaluated. Subsequently, the results of DSR need to contribute to the environment by offering an applicable artifact and to the knowledge base by expanding it (Hevner et al., 2004). The principle that knowledge and understanding are derived from the building, application, and evaluation of an artifact is the foundation of the corresponding guidelines (Hevner et al., 2004; S. T. March & Smith, 1995). This framework applies the six-step research process defined by Peffers et al. (2007). The essential validation step is designed by following the theory by Venable et al. (2012). Altogether, this results in scientifically grounded research in the field of management and entrepreneurship studies.

To conduct scientifically sound research, the choice of research methods is a fundamental step. In light of this work, it is important to notice that exploration is a research method of particular significance and value in research projects, which are characterized by a limited knowledge base and with a link to practice (Bortz & Döring, 2013; Brown, 2006). Exploration is one of three research methods of empirical research and is well suited for the development of scientific and technological theories in applied science. Within exploration, four strategies for the enhancement of the knowledge base can be distinguished (Bortz & Döring, 2013):

- Theory based exploration: based on systematic literature review and analysis, novel insights and findings are derived.
- Method based exploration: review and reflection of existing methods and results with the goal to reveal connections, interrelations or differences by comparing and varying of these methods in a field of studies.

- Empiric quantitative exploration: based on the statistical analysis of quantitative data, undetected or ignored patterns are uncovered and described.
- Empiric qualitative exploration: analysis and review of qualitative data, aiming at the discovery and explanation of unacknowledged phenomena as well as the identification of connections and interrelations.

This dissertation primarily applies theory-based and empiric-qualitative exploration. Theory-based exploration begins with an extensive literature review to generate an overview and deepened understanding of the research area. Subsequently, new epistemological models are developed through integration, critical review, and the experience of the researcher (Bortz & Döring, 2013). For this research project, the empirical research strategy is of critical importance in the development of the artifact Value Delivery Architecture Modeling. VDAM bases upon the combination of the existing artifacts, Value Delivery Modeling Language (Object Management Group, 2014, 2015) and ontology building (Ehrig & Studer, 2006; Maedche, Staab, & Studer, 2001; Osterwalder, 2004), which will be introduced in detail in Chapter 2.

Expert interviews and workshops, as part of an empiric-qualitative exploration, are used in several steps of the research project to complement the theory-based exploration. The technique of semi-structured, problem-focused expert interviews is in the focus of the raw data collection process. This technique is selected due to its explorative character and fit to situations in which some expertise and knowledge about the research topic do already exist (Mayring & Brunner, 2009). Experts are characterized as having in-depth knowledge of and being involved in a particular area (Meuser & Nagel, 2009; Trinczek, 2002). Semi-structured, problem-focused experts interviews grant the researcher some leniency concerning the subject matter and sequence of the questions (Diekmann, 2007). The goal of this tolerance is to allow the expert to reply as open and as freely as possible by creating more of an environment of a conversation than an interview. Additionally, the interviewer is enabled to be responsive to remarks of the interviewee in order to gather insightful information (Glaeser & Laudel, 2010). Besides clear and insightful information, such as specific expert statements, executing interviews also generates irrelevant, contradicting or difficult to interpret data that needs to be analyzed, e.g. by applying qualitative content analysis (Glaeser & Laudel, 2010; Mayring & Brunner, 2009; Mayring & Fenzl, 2014; Spöhring, 2013). In the application context, three basic principles can be distinguished through sensitive interpretation and correlation of statements (Diekmann, 2007; Mayring & Brunner, 2009; Mayring & Fenzl, 2014):

- Abstraction: paraphrasing of statements by focusing on the key message
- Explication: complementing context information to enhance the understanding and interpretation
- Structuring: revealing aspects of form and content, patterns, and structures based on criterions.

In this research project, all three principles are applied in order to analyze the transcriptions of the interviews with the experts of the domain of fast charging infrastructure in Germany. The result of this

analysis is used to model a frame of reference for the value network which is subsequently employed to illustrate the opportunities generated by VDAM. Additionally, it is applied through the evaluation process of VDAM in this new domain. In all cases, the qualitative data analysis (QDA) is carried out by using the software ATLAS.ti, thereby employing computer-assisted QDA (Kuckartz, 2013). Exercising a quantitative evaluation strategy using a questionnaire complements the qualitative evaluation step. Integrating quantitative elements in research projects which are mainly focusing on qualitative research methods augment the opportunity to generalize the findings (Mayring, 2001). Altogether, this research project is following the suggestions of Venable et al. (2012) by using case studies as well as qualitative and quantitative surveys to ex post evaluate the resulting artifact of DSR in a naturalistic environment.

1.4 Structure and contribution of the work

To provide context for the research project in the area of fast charging infrastructure as well as to inform about scope and structure of the present work, Chapter 1 displays the motivation (see Chapter 1.1) and statement of the problem (see Chapter 1.2). Display of the research strategy based on the research design and the methods applied in this work follows next (see Chapter 1.3). To guide the reader through the dissertation this subchapter (see Chapter 1.4) provides the structure of the work, including the content and contribution of each part. Thus, this chapter enables the reader to get a general understanding of the topic as well as an understanding of why research in this new field is of importance and how it is performed.

An extensive discussion of the theoretical background of this work including a comprehensive research review follows next (see Chapter 2). After introducing the theoretical foundation of model creation and framework development with case studies (see Chapter 2.1), Chapter 2.2 displays the current situation of business model theory. Additionally, I introduce and analyze selected business modeling approaches, including Value Delivery Modeling Language (Object Management Group, 2014, 2015) (see Chapter 2.2). Ontologies in business modeling is another topic of interest for this dissertation. Hence, a general introduction to ontology building, including guidelines and examples of their use in business modeling is conducted (see Chapter 2.3). The research review reveals the academic gap in business modeling and answers the first research question. Additionally, it conveys implications for the research efforts towards a new approach that facilitates business modeling in domains with complex value creation networks, e.g. fast charging infrastructure (see Chapter 2.4). As displayed in Figure 3, this chapter introduces the theoretical basis for the empiric explorative study (see Chapter 3) and is input for the Value Delivery Architecture Modeling framework (see Chapter 4) as well as for the subsequent evaluation of its instantiation (see Chapter 6).

Following the theoretical foundation, Chapter 3 displays the empirical explorative study in the domain of fast charging infrastructure in Germany. After deepening the understanding of this new area (see Chapter

3.1), setup and execution of the study (see Chapter 3.2) and the coding process based on qualitative content analysis is introduced (see Chapter 3.3). Subsequently, I display the results based on the QDA concerning profitability (see Chapter 3.4) and the value creation network (see Chapter 3.5). These results emphasize the complex situation in this new domain and the need for a new approach to business modeling with more focus on the value creation and delivery network (see Chapter 3.6). As displayed in Figure 3, the findings of this section are used for the VDAM framework (see Chapter 4) and its instantiation in the domain of fast charging infrastructure in Germany (see Chapter 0).

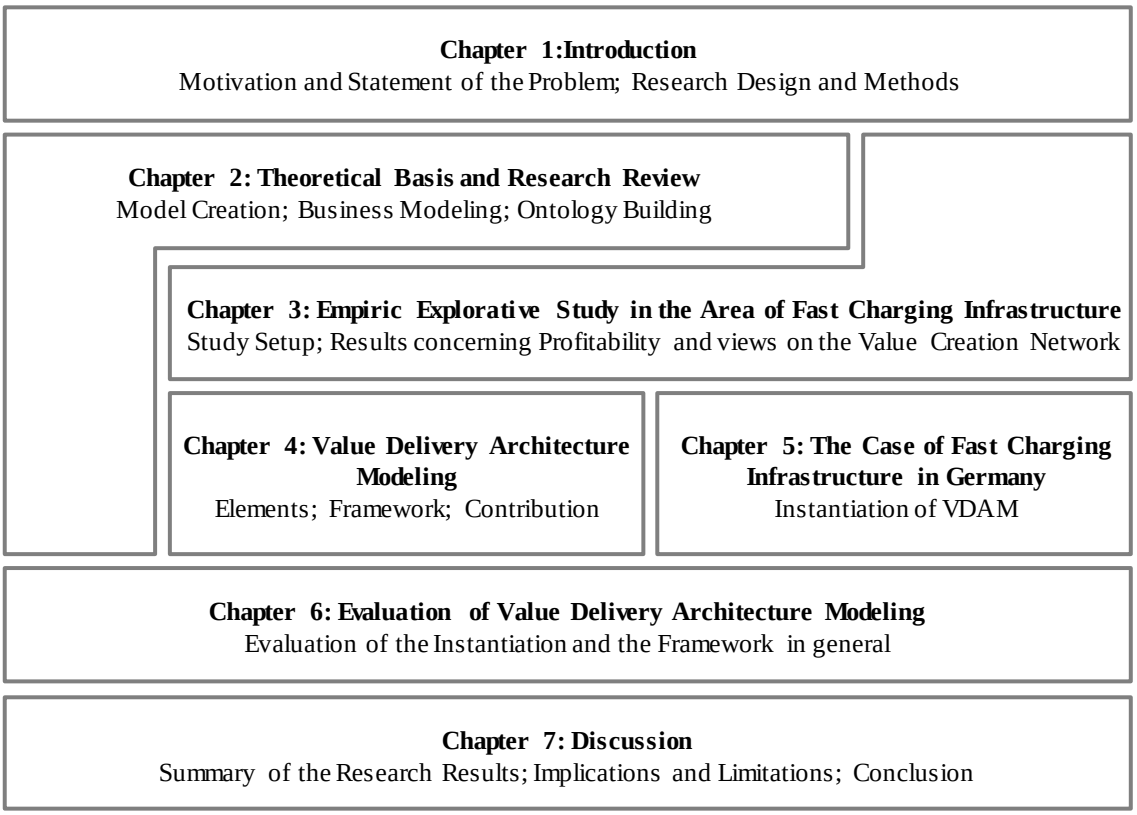


Figure 3 - Structure of the work

Next, I introduce the newly developed business modeling approach Value Delivery Architecture Modeling. First, based on the research review and the empiric study, the motivation for this new approach is derived (see Chapter 4.1). In accordance with design science, two existing artifacts serve as the basis for VDAM. Thereby, Value Delivery Architecture Modeling (Object Management Group, 2014, 2015) contributes valuable visualization tools (see Chapter 4.2), which are complemented by ontology building (see Chapter 4.3). I combine these two existing artifacts to address the critical challenge in entrepreneurship of enabling a favorable positioning in the value network. Additionally, VDAM enables profitability assessments of business model ideas within the value creation network (see Chapter 4.4). Value Delivery Architecture Modeling is a systematic approach for business modeling including a framework to apply (see Chapter 4.5).

Therefore, the approach allows modeling of the overall value creation and delivery in a domain as well as the underlying processes and concepts necessary for the value creation and delivery to support the subsequent operationalization. Altogether, the approach allows for a well-founded decision on if and how to implement a new business model based on the positioning in the value network (Chapter 4.6).

I apply this newly developed approach in the domain of fast charging infrastructure in Germany. There are some circumstances that are characteristics for this area and which should to be taken into account (see Chapter 0). Chapter 5.1 displays how the VDAM approach can be used to model the value network of the domain of fast charging infrastructure in Germany and how specific companies can be positioned in this frame of reference. This frame of reference enables different types of analyses that all lead to a more informed decision on if and how to implement a new business model in this domain (see Chapter 5.2). Additionally, VDAM allows for the (re-) design of the value creation network based on new business model ideas. Chapter 5.3 displays a case study conducted in the domain which shows the potential of redesigning the value network. Furthermore, modeling of underlying views within the framework is presented. which deepens the understanding of value creation and furthers the potential of the subsequent operationalization of a business model idea. Therefore, this chapter shows the successful instantiation of the newly developed artifact Value Delivery Architecture Modeling and shows its scientific validity (see Chapter 5.4).

Following the logic of design science, scientific validity, as demonstrated by the instantiation of the framework in Chapter 0 is important, but the evaluation of the artifact (see Chapter 6) is highly relevant as well. After introducing the evaluation methods applied in this dissertation (see Chapter 6.1), I display the evaluation of the instantiation of VDAM in the domain of fast charging infrastructure in Germany. The extended evaluation of the approach concerning its applicability in other fields follows (see Chapter 6.3). This chapter closes with a concluding summary of the evaluation results for the instantiation and the framework in general (see Chapter 6.4).

This dissertation concludes with an in-depth discussion of the research project. This chapter starts with a reflection on the purpose of the research and a summary of the findings (see Chapter 7.1). These scientific discoveries are complemented by displaying their implications for practice; both in the domain of fast charging infrastructure in specific, but also in a more general perspective (see Chapter 7.2). Nonetheless, any research project has its limitations, which I address in Chapter 7.3. Additionally, in this subchapter, I introduce some ideas and recommendations for future studies in the area of business modeling with a focus on value creation. This dissertation ends with a short conclusion of the research displayed (see Chapter 7.4).

2 Theoretical basis and research review

This chapter presents the theoretical basis relevant to the development of VDAM and thereby builds the underlying theoretical basis for the research project. It begins with the introduction into the theoretical basis and methodology of model creation (see Chapter 2.1), covering the concept of a model (see Chapter 2.1.1), guidelines of modeling (see Chapter 2.1.2), and the theoretical implications of case-based model development (see Chapter 2.1.3). An extensive discussion of business model theory (see Chapter 2.2.1) and today's challenges based on increased complexity, distributed value creation, and embeddedness in the supply chain follows next (see Chapter 2.2.2). After discussing selected business modeling approaches prominent in practice about their fit towards today's requirements in business modeling (see Chapter 2.2.3), UML-specified Value Delivery Modeling Language is introduced (see Chapter 2.2.4). Value Delivery Modeling Language (Object Management Group, 2014, 2015) is one of the two artifacts that are combined to describe and depict value creation networks (Pathak, Day, Nair, Sawaya, & Kristal, 2007) and the embeddedness in the supply chain (Song, Podoynitsyna, Van Der Bij, & Halman, 2008) of an innovative venture as part of Value Delivery Architecture Modeling. Subsequently, I introduce the second artifact constituting VDAM: ontologies. After introducing origin, characterization, and aims of ontologies in general (see Chapter 2.3.1), the process of and guidelines for ontology building are presented (see Chapter 2.3.2). This follows the display of the relevance of ontologies in business modeling (see Chapter 2.3.3). In Chapter 2.4 the findings of the previous subchapters are combined, and their implications for the subsequent work are discussed.

2.1 Theoretical basis and methodology of model creation

The core of this dissertation is the development of a new approach to business modeling, focusing on the integration into the value network. Consequently, it is important to introduce the underlying theory and methodology of model creation to achieve a shared understanding of the basic concepts. Thus, the concept of a model as a representation of real, complex systems is introduced in Chapter 2.1.1, followed by guidelines for modeling to ensure the quality of the resulting models (see Chapter 2.1.2). Subsequently, potentials for framework development based on case study research are introduced and their implications for the present work are discussed (see Chapter 2.1.3). Hence, Chapter 2.1 provides a sound presentation of the model concepts, preparing for business model theory (see Chapter 2.2) and ontology building (see Chapter 2.3).

2.1.1 Concept of a model

Models are representations of real, complex systems and are being used to describe and solve specific problems (Schweitzer, 2009). A system is defined as a meaningfully composed whole (Kluge, 1894) or a '*complex whole"* (Oxford University Press, 2015) consisting of elements with attributes and relationships among each other (Franken & Fuchs, 1974; Horváth, 2012; Klein & Scholl, 2012). Types of models can be discerned by comparing a model to the original in the dimensions of structure and subject matter (Schütte, 2013). If original and model are as similar as possible to the subject matter, the model is isohyl. A low level of similarity in that dimension is defined as analog. Concerning the structural dimension, there is a distinction between homomorphic and isomorphic models. The latter require structural identity, while models are described as homomorphic if it only represents a part of the original or if the model is simplifying the original (Klein & Scholl, 2012; Stachowiak, 1973). With regards to the definition that a system or model is a meaningfully composed whole, models are not a reproduction of reality but the result of a structuring process (Schütte, 2013). The context-oriented modeling concept describes this understanding as well, which acknowledges the influence of factors such as model designer, model user, and modeling language on the resulting model. This leads to the development of a solution instead of a homomorphy reproduction (Rieper, 1992). Because the model designer makes the decision on the design of a model, a model is always influenced by subjectivity, at least to some extent (Dresbach, 1999).

The literature mentions a variety of different types or classes of models. The following attributes characterize these models: purpose, measurement level, format, completeness of information, time reference, structure, and number of criteria (Adam & Witte, 1976; Klein & Scholl, 2012; Pfohl, 1997; Scholl, 2000; Stachowiak, 1973). Amongst others, Brandt (2016) describes these attributes and puts them in a morphological box (see Figure 4) to support the classification and characterization of models. This approach is facilitating a meaningful decision towards what type of model to develop. The definition of the purpose is the key attribute for a focused formulation of a model and should be conducted first (Bossel, 1992). While, according to Brandt (2016), there is some thematic overlap between model attribute types, a classification based on this morphological box is possible and meaningful to enable a focused model design. Only one possible characteristic per attribute type is permitted (Brandt, 2016).

The before mentioned subjectivity of modeling based on experience, model focus and other factors also leads to varying design elements. Particularly the number and type of attributes vary. Of fundamental importance for the decision of element design is the purpose of the model as well as the structure of the content and the interpretation of the problem (Dresbach, 1999).

Model attribute	Possible characteristics of the model attribute				
Purpose	descriptive	causal	prognostic	decision	simulation
Measurement Level	quantitative		qualitative		
Format	formal	physical	graphical	verbal	
Information Completeness	deterministic		stochastic		
Time reference	static		dynamic		
Structure	homomorphic		isomorphic		
Number of criteria	single		multiple		

Figure 4 - Morphological box of model attributes for categorization, based on Brandt (2016)

It is essential to handle the complexity displayed in models to ensure the applicability of models for real-world problems and challenges. In other terms, models need to be simplifications of the complex reality, or otherwise, they would not be useful (Siggelkow, 2007). Thereby, three different types of complexity can be distinguished (Becker, Delfmann, Knackstedt, & Kuropka, 2002):

- Element complexity: determination of number and scope of elements among the model variants
- Relations complexity: description of relationships between elements
- Dynamic complexity: determination of rules of conduct and configuration within the model

Complexity reduction and complexity management are the two dominant approaches to handling overall complexity. Complexity management has the goal to ensure consistency amongst the model elements. This can be supported and facilitated by applying modeling tools within the modeling process. Complexity reduction, on the other hand, focusses on eliminating unnecessary model variants, relationships among the elements, and rules of conduct as well as configurations within the model (Becker et al., 2002). While handling complexity, oversimplification needs to be avoided, so that the purpose of the model (see above) is still covered.

Models are representations of real, complex systems (Schweitzer, 2009) and can be classified according to the morphological box developed by Brandt (2016). The key to any model is its purpose, which needs to be defined meticulously (Dresbach, 1999). To ensure applicability in practice, the corresponding complexity needs to be handled by complexity reduction and complexity management (Becker et al., 2002) without compromising the model purpose. Subsequently, general guidelines of modeling are discussed that are

supposed to ensure the quality of models (see Chapter 2.1.2) and the theoretical foundation of framework development will be introduced (see Chapter 2.1.3).

2.1.2 Guidelines of Modeling

Becker et al. (1995) present the Guidelines of Modeling (GoM) with the goal to create a framework to ensure not only the correctness of syntax but also quality in information modeling. This is necessary due to the increased application of models not only as conceptual designs but because they are used to aid in organizational design and other areas (Becker, Rosemann, & Schütte, 1995). While developing and naming GoM, Becker at al. (1995) have been influenced by the Generally Accepted Accounting Principles (GAAP) and even adapted some of these principles towards modeling (Becker, Rosemann, & Von Uthmann, 2000). Since their instantiation, the GoM have been refined and applied to a variety of fields, e.g. process oriented modeling (Rosemann, 1998), business process modeling (Becker et al., 2000; Delfmann, 2006), and reference modeling (Delfmann, 2006; Schütte, 2013). The six general guidelines are (Becker et al., 1995, 2000):

- Guideline of Correctness: This guideline affects two aspects of a model: syntax and semantics. To postulate syntactical correctness, a model needs to be consistent and complete when compared to the meta-model. Semantic correctness is reached if the structure and behavior of a model are consistent with the real world.
- Guideline of Relevance: Relevance is reached if elements of a model cannot be deleted without loss of meaning to the model user. To ensure relevance, the purpose of the model needs to be stated explicitly, and the level of abstraction needs to be defined accordingly.
- Guideline of Economic Efficiency: Economic efficiency has been reached once the cost of additional modeling exceeds the added benefit. This guideline affects all other guidelines because it adds a restricting factor to the efforts in these categories. Even though there is no theory of cost/ benefit equations on modeling, a model designer should always be aware of this guideline.
- Guideline of Clarity: Even though this guideline is very subjective, it is nonetheless highly significant to modeling. Without comprehensibility and usability of a model, all other modeling efforts are useless. Therefore, the clarity of a model shall not be determined by the designer of a model but by its users.
- Guideline of Comparability: This guideline directly corresponds with the GAAP's comparability principle and stipulates the consistent use of the guidelines within a modeling project. An ostensive example is the conformity of naming conventions.
- Guideline of Systemic Design: This guideline demands clear relationships between different model views, such as organization view, function view, or resource view. As a minimal requirement, there shall be a meta-model that includes all relevant views.

The first three guidelines correctness, relevance, and economic efficiency are mandatory guidelines while the latter three are more optional (Becker et al., 2000). However, the six guidelines show interrelations between each other (Becker et al., 1995).

Amongst others, Schütte and Rotthowe (1998) as well as Becker (1998) state that the GoM increases clarity, consistency, and quality of reference modeling (Becker, 1998; Schuette & Rotthowe, 1998). I argue that application of these principles shall not be restricted to the modeling of information models (Schuette & Rotthowe, 1998) or business process modeling (Becker et al., 2000) but are also of importance to business modeling including the modeling of value creation networks.

2.1.3 Framework development with case studies

The former subchapters introduce the concept of a model (see Chapter 2.1.1) and guidelines of modeling (see Chapter 2.1.2) and need to be considered with regard to theory building and framework development. As Colquitt and Zapata- Phelan (2007) show in their longitude study about the Academy of Management Journal (AMJ) the total number and the relative share of papers concerning theory building and theory testing increased significantly over the last 40 years. For their study, they group the articles published in AMJ in 5 archetypes: reporters, qualifiers, testers, builders, and expanders (see Figure 5). While publications in the reporter category show low theoretical contribution, papers from the archetypes testers, builders, and expanders show a high level. Qualifiers are in the mid-range. In this context, the high theoretical contribution is characterized by a high amplitude in at least one of the two dimensions of new theory building, e.g. by introducing new constructs, or testing of existing theory, e.g. by grounds prediction with current theory (Colquitt & Zapata-Phelan, 2007).

Following Eisenhardt and Graebner (2007), new theory development based on a case study is highly relevant in this context. There is not only a disproportionally large number of relevant studies based on single or multiple cases, but they cover very diverse topics (Eisenhardt & Graebner, 2007). Thereby, the case studies are motivation, inspiration, and illustration of the research project. Motivation refers to the fact that a case is often a good way to motivate a research question by showing how a topic is relevant and therefore can be superior to purely conceptual research. Additionally, cases can be starting points for new ideas or shape existing theories and therefore act as inspiration for further research. Last, but not least, a concrete example as an illustration of a phenomenon can make it easier for the reader to understand the research and its relevance (Siggelkow, 2007). By addressing questions of how, what, and why some phenomenon exists, theory based on case study is one of the best ways to connect rich qualitative evidence to mainstream deductive research (Eisenhardt & Graebner, 2007).

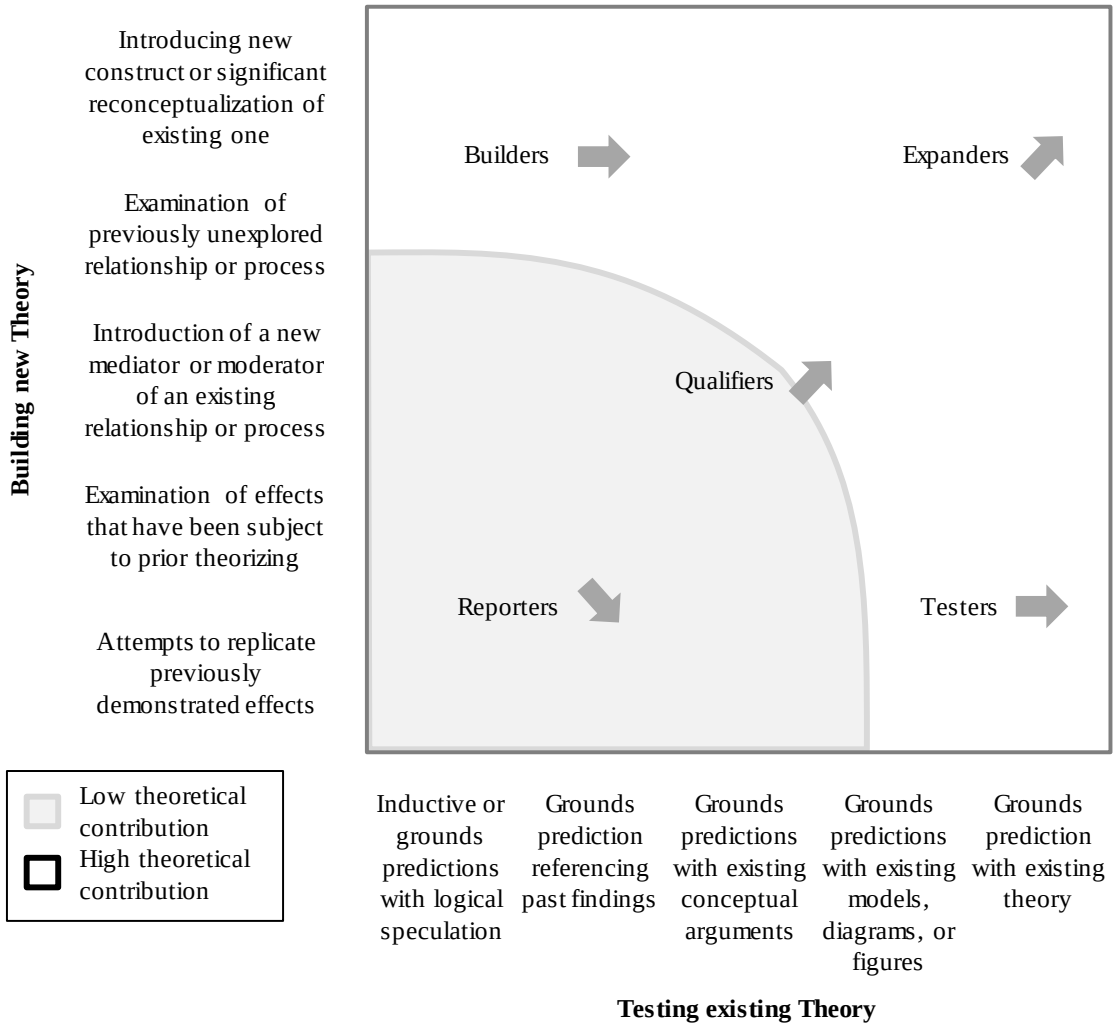


Figure 5 - Taxonomy of theoretical contribution for empiric articles (Colquitt & Zapata- Phelan, 2007)

Nonetheless, legitimate criticism of theory building based on case studies exists (see Figure 6). One of the key arguments against case based theory building is the missing representativeness of a phenomenon so that conceptual insights or even generalizations are not possible and therefore the scientific impact is low (Siggelkow, 2007). Furthermore, missing theoretical sampling and the risk of data bias, meaning the retrospective sense making by image conscious informants, leads to biased results and therefore little scientific value (Eisenhardt & Graebner, 2007). An additional criticism bases on the potential, that case studies might be descriptive, hence merely address theoretical situations (Siggelkow, 2007) and ambiguity about scientific terms relevant to research that complicates the line of argument (Eisenhardt & Graebner, 2007). Aggravating this situation is the fact, that there is no generally accepted structure or template to write about theory-building research. Hence, it can be challenging to present evidence from case studies and use it to derive theory. (Eisenhardt & Graebner, 2007).

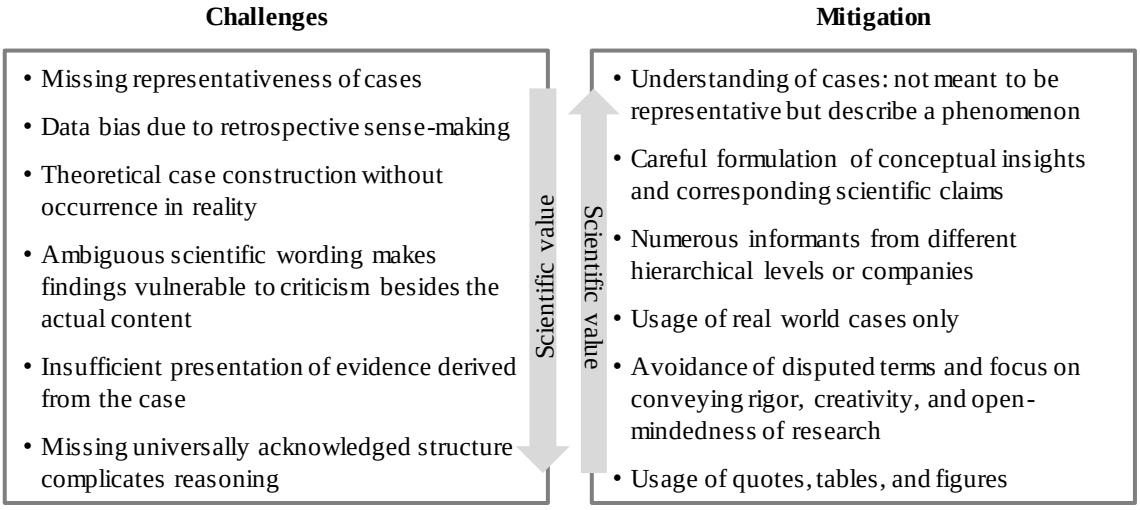


Figure 6 - Challenges and mitigation approaches for theory building based on case studies

This legitimate criticism can be faced with a number of provisions, linked to the general understanding of case value, line of argument, and corresponding aspects (see Figure 6). First of all, especially true for single case theory building, case bias is not a real challenge because the case or cases are mainly chosen just because they show an interesting phenomenon and therefore are revelatory (Yin, 1994). Case studies are an unusual access to interesting research topics based on sometimes extreme examples whereby the researcher exploits the opportunity to explore a significant phenomenon under rare circumstances (Eisenhardt & Graebner, 2007). And even though a case might not be representative of all companies or applicable to every industry and therefore can't be considered universal, it can still create insight for interesting research topics. Consequentially, researchers shall be careful about the theoretical and conceptual insights generated by a single case or a limited number of cases and the corresponding claims for science (Siggelkow, 2007). Data bias of case studies can be minimized or even avoided by including diverse perspectives into the case study, e.g. by having numerous informants from different hierarchical levels or different companies. Careful reasoning, the omittance of ambiguous wording, and by focusing on conveying rigor, creativity, and open-mindedness of the research process instead are ways to mitigate other challenges (Eisenhardt & Graebner, 2007). Avoidance of theoretical or fabricated cases is another way to alleviate the criticism on case study based theory building, or as Siggelkow puts it: if you write about a talking pig, you better make sure to have a talking pig (Siggelkow, 2007). Additionally, presenting a relatively complete rendering of the story, including quotations, tables, and figures helps to introduce the evidence from which theory is inducted (Eisenhardt & Graebner, 2007). The present work takes these aspects into consideration.

2.2 Business model theory and entrepreneurship

Increased competition, globalization, and converging industry barriers change the existing rules within industries and force companies to transform, in other words, to innovate. Empiric results show that business model innovation (BMI) increases the probability of success, compared to the mere product or process innovation (Gassmann, Frankenberger, & Csik, 2013). This subchapter displays the current situation of business model theory, research, and practice. Today, there is still no generally accepted definition of what a business model is (e.g. Lindgren & Rasmussen, 2013; Zott, Amit, & Massa, 2011). Nonetheless, the description of value creation as part of innovation is considered highly significant and an essential activity of entrepreneurship (Metzger et al., 2016) (see Chapter 2.2.1). Even though empiric data clearly reveals that embeddedness in the supply chain is of key importance to the success of companies (Song et al., 2008) (see Chapter 2.2.2), prevailing business modeling approaches do not sufficiently incorporate this success factor (see Chapter 2.2.3). On the other hand, a newly developed business modeling language, Value Delivery Modeling Language (VDML) includes views that enable an entrepreneur, intrapreneur or business model innovator to pay respect to the embeddedness in the supply network (see Chapter 2.2.4).

2.2.1 Current situation of research and application of business model theory

For the last two decades, business models have received substantial attention in science and practice. As Zott et al. (2011) show, peer- reviewed academic journals published approximately 1.200 articles within 15 years. They are mainly addressing e-business, strategic issues linked to value creation, as well as innovation and technology management (Zott et al., 2011). While the business environment gets more and more competitive and is characterized by complexity and turbulence, business models gain even more popularity and importance (Onetti, Zucchella, Jones, & McDougall-Covin, 2012). Typical approaches for business modeling discussed in the literature and applied in practice include the Business Model Canvas (Osterwalder & Pigneur, 2010), the Business Model Navigator (Gassmann et al., 2013) and the Business Model Cube (Lindgren & Rasmussen, 2013). In one way or another, all approaches develop a model to describe the systemic arrangement of a venture, including its key components and interactions. This is interesting, because there is a lack of a broadly accepted definition of the term business model, which has already been criticized in 2005 (Morris, Schindehutte, & Allen, 2005a). Besides considerable efforts in the scientific community, no such universal definition has emerged (Bieger, Zu Knyphausen-Aufseß, & Krys, 2011; Gassmann et al., 2013; George & Bock, 2011; Lindgren & Rasmussen, 2013; McGrath, 2010; Onetti et al., 2012; Osterwalder & Pigneur, 2010; Servatius, 2012; Van Aken & Romme, 2012). According to Zott et al. (2011), researchers tend to adopt definitions that support the purpose of their studies. This creates vast theoretical gaps and inconsistencies, altogether hindering the cumulative progress in the domain (Zott et al., 2011).

While a universal definition of what a business model is still missing, already Morris et al. (2005) capture some common theoretical foundation between business model approaches. They argue, that the deduction of Porter and Millar (1995) still holds true today: business model constructs build on the value chain concept, the creation of competitive advantage, and strategic positioning (Morris, Schindehutte, & Allen, 2005b; Porter, Goold, & Luchs, 1996; Porter & Millar, 1985). Additionally, business model approaches engage in strategic network theory (Jarillo, 1995) and cooperative strategies (Dyer & Singh, 1998) as well as in resource-based theory due to the perception of companies as an assortment of resources and capabilities (Barney, Wright, & Ketchen, 2001). Relevant parts of the scientific community have suggested that business models should be considered critical constructs for understanding value creation (e.g. Amit & Zott, 2001; Chesbrough & Rosenbloom, 2002). Based on a broad literature review, George and Bock (2010) distinguish six different associations to business model theory (see Table 1): organizational design, resource- based view, narrative and sense making, the nature of innovation, the nature of opportunity, and transactive structures (George & Bock, 2011).

Table 1 - Topics of business model literature, based on George and Bock (2010)

Topic	Summary	Representative definition
Design	Agent-driven or emergent configuration of firm characteristics	'A business model is an architecture for product, service, and information flows, including a description of the various business actors and their roles' (Timmers, 1998)
Resource-based view	Organizational structure co-determinant and co-evolving with firm's asset stock or core activity set	'Each business model has its own development logic which is coherent with the needed resources – customer and supplier relations, a set of competencies within the firm, a mode of financing its business, an a certain structure of shareholding' (Mangematin et al., 2003)
Narrative	Subjective, descriptive, emergent story or logic of key drivers of organizational outcomes	'[Business models] are, at heart, stories – stories that explain how enterprises work' (Magretta, 2002)
Innovation	Processual configuration linked to evolution or application of firm technology	'The business model provides a coherent framework that takes technological characteristics and potentials as inputs and converts them through customers and markets into economic outputs' (Chesbrough & Rosenbloom, 2002)
Transactive	Configuration of boundary-spanning transactions	'A business model depicts the content, structure and governance of transactions designed so as to create value through the exploitation of business opportunities' (Amit & Zott, 2001)
Opportunity	Enactment and implementation tied to an opportunity landscape	'[The business model] is a set of expectations about how the business will be successful in its environment' (Downing, 2005)

According to Al-Debei and Avison (2010), business models cover four dimensions (see Figure 7): value proposition, value architecture, value finance, and value network (Al-Debei & Avison, 2010; Al-Debei &

Fitzgerald, 2010). These dimensions of a business model concept cover different aspects but are highly interrelated and interdependent. The value proposition dimension refers to the way in which an organization creates value with its partners for the customer or even how they create value for all stakeholders involved (Al-Debei & Avison, 2010; Amit & Zott, 2001; Andersson et al., 2006; Magretta, 2002; Osterwalder, Pigneur, & Tucci, 2005). Therefore, this dimension addresses products and services, including the value elements incorporated as well as the target market segments. Value architecture, in the definition of Al-Debei and Fitzgerald (2010), focusses on resources of an organization, their configuration, and the core competencies. This dimension refers to the resource-based view of an organization, stating that each company is a bundle of resources that can be arranged to generate value in the most effective and efficient way (Al-Debei & Avison, 2010; Barney et al., 2001). Value finance as a dimension refers to costs, pricing methods, and revenue structures, aiming at an efficient setup to generate a beneficial financial output for an organization (Al-Debei & Avison, 2010; Osterwalder et al., 2005; Shafer, Smith, & Linder, 2005). The fourth dimension is called value network. It addresses cross-company relationships within a business model (Al-Debei & Avison, 2010). Included aspects are relationships and interaction modes amongst stakeholders, whereby these stakeholders can be seen as actors taking on roles in the value network and exchanging value via channels (Gordijn, Akkermans, & Van Vliet, 2000). These actors can be partners, governmental agencies, or competitors, which can be summarized as organizational actors as well as customers (Al-Debei & Avison, 2010; Bouwman, 2002; Giaglis, Kallio, Tinnilä, & Tseng, 2006) resulting in a multi-party stakeholder network (Gordijn, Akkermans, & Van Vliet, 2001).

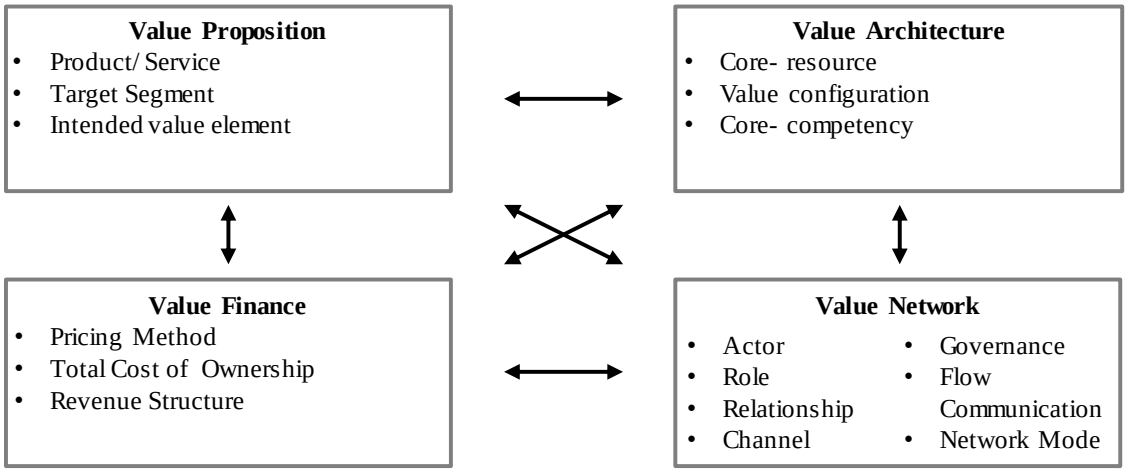


Figure 7 - V4 BM dimensions derived from Al-Debei & Avison (2010) and Al-Debei & Fitzgerald (2010)

Despite scientific differences among researchers about what precisely a business model is, there is widespread agreement that the business model is a new, distinct approach of analysis aiming to explain how companies do business. Additionally, activities conducted by a corporation and its partners are in the focus of the existing conceptualizations, trying to explain value creation and value capture (Zott et al.,

2011). According to Al-Debei and Avison (2010), business models primary use are three functions (see Figure 8):

- As a conceptual tool of alignment between strategy and business process
- As an interceding framework between technological artifacts and attainment of strategic goals
- As strategic-oriented knowledge capital that answers questions related to value creation

Alignment between strategy and business processes becomes more and more challenging in today's market due to the more dynamic environment, continuous fast changes, and increased stakeholder pressure. Considering a business model as a conceptual tool of alignment, it can fill the emerging gap between strategy and processes by providing harmonization between these organizational layers (Al-Debei & Avison, 2010). Besides supporting the conceptual alignment, business models can act as an interceding framework between technology innovation and strategic objectives. A successful business model unlocks latent value of technology by displaying the logic between technological innovation and economic value creation (Chesbrough & Rosenbloom, 2002). Thus, a business model can be seen as a systematic and consistent approach to technology design, evaluation, and management with the goal to reach strategic and economic objectives and success (Al-Debei & Avison, 2010). It can be a valuable vehicle for innovation (Massa & Tucci, 2013). Additionally, business models are crucial to depict the underlying logic of a business system that answers questions towards value creation, configuration, and exchange. By providing the appropriate and necessary level of information, the explicit description of business model can mobilize organizational knowledge capital and improve strategic decision making (Al-Debei & Avison, 2010). According to Massa and Tucci (2013), this knowledge can lead to BMI which needs to be considered a distinct but complementary origin of innovation just as new products or services. This holds true even for mature industries, e.g. by performance improvements based on BMI (Zott & Amit, 2007).

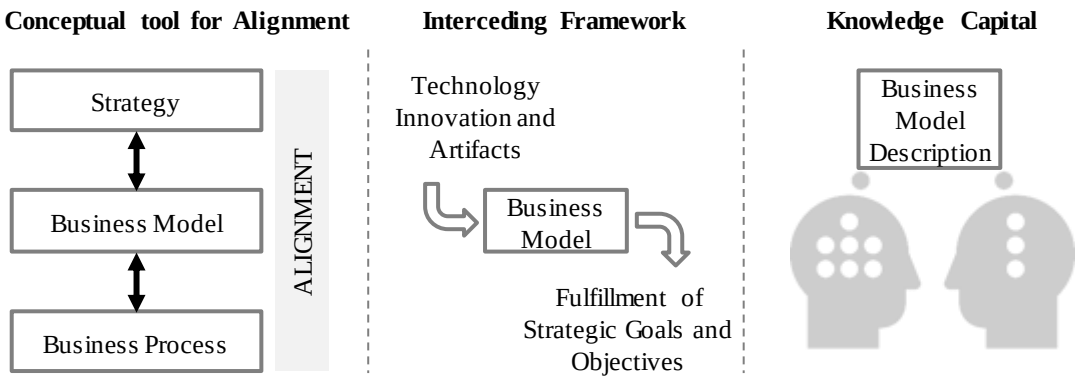


Figure 8 - Prevailing business model functions, based on Al-Debei und Avison (2010)

With respect to value creation, it is important to recognize that any venture is embedded in a complex and dynamic network of industry structures and the positioning within this value network can be of critical

importance for the value creation (see Chapter 2.2.2). Therefore, the relationships with suppliers, partners, and customers are addressed in most business modeling approaches (Morris et al., 2005a). These so-called supply networks are composed of a variety of roles and a potentially large number of companies, sometimes from multiple interrelated industries. The importance of the positioning within the value network reaches further groundedness by the work of Song, Podoynitsyna, van der Bij, and Halman (2008). In their meta-analysis of success factors for startups, the 'embeddedness in the supply chain' is named of prominent importance for the success of a new venture (Song et al., 2008).

This is important, because, according to Zott and Amit (2007) the design of a business model is the prominent task in entrepreneurship (Zott & Amit, 2007), driving the strategic design in new entrepreneurial ventures (Onetti et al., 2012). In this context, entrepreneurship is the process in which companies or individuals in companies explore and exploit opportunities by managing uncertainty in a proactive way (J. G. March, 1991). Within this process entrepreneurs face three different kinds of challenges (Sarasvathy et al., 2008):

- Knightian uncertainty
- Goal ambiguity
- Isotropy

Isotropy means that ex ante it is not clear what elements of the environment are important and which information is relevant. Therefore, it is unclear to what to pay attention to (Sarasvathy et al., 2008). Goal ambiguity addresses that preferences, especially of customers and other market participants, are neither given nor well ordered (e.g. J. G. March, 1976). Knightian uncertainty refers to the fact that it is impossible to calculate probabilities for future consequences (e.g. J. G. March, 1978). These challenges, in turn, constitute the general design space of entrepreneurs in which they can act, in which they can develop new opportunities, and that they can exploit (Sarasvathy et al., 2008).

Faltin and Ripsas distinguish two types of entrepreneurship: the technology-based entrepreneurship and the conceptual-creative entrepreneurship. Their view on entrepreneurship perceives technology as just one of two sources of development. The second one is entrepreneurial creativity. This creativity can be based on the recombination of existing resources, principles, or processes as well as the transfer of these elements into new domains (Faltin & Ripsas, 2011). There are two kinds of creativity-centered business model designs: efficiency-centered business models to achieve transaction efficiency and novelty- centered business models, referring to the development of innovative approaches to conduct economic exchange. Empirical findings show that especially the latter type shows a positive association with the company performance. Ways to attain novelty-centered business models are, for example, by creating new connections among parties, changing the linking of existing connections, or by developing new transaction

instruments (Zott & Amit, 2007). Therefore, business modeling shall go beyond internal design (Nystrom & Starbuck, 1981) and include a focus on the architecture of transaction with partners (Zott & Amit, 2007).

In this light, I argue that business modeling approaches need to provide tools and methods to analyze, evaluate und design the position of a company within its value creation network. Hence, they need to address the relationship between a company and its network of exchange partners (Massa & Tucci, 2013; Osterwalder et al., 2005; Zott et al., 2011). This is of particular importance for start-ups and companies active in turbulent industries (N. Franke, Gruber, Harhoff, & Henkel, 2008) because it helps to make more informed decisions which lead to increased chances of success (Harms, Kraus, & Reschke, 2007; Trimi & Berbegal-Mirabent, 2012). The subsequent chapter discusses in more detail the topics of complexity, value creation, and embeddedness in the supply network (see Chapter 2.2.2). A discussion of selected business modeling approaches including their depiction of these topics follows (see Chapter 2.2.3). The introduction of a new business modeling language that I deem suitable to offer additional value by creating the opportunity to model the value creation and delivery of a domain completes this section (see Chapter 2.2.4).

2.2.2 Complexity, value creation, and embeddedness in the supply network

Nowadays, many companies conduct their business as networks. Additionally, companies' value chains are embedded in other ventures' interdependent value chains, creating a value network (Huemer, 2006). Therefore, Gunawardhana et al. (2015) argue that business models need to be concerned not only with the company, but with the network as a whole. Business model literature shows that it is a system of interrelated and interdependent tasks, not limited to the focal company but transcending its boundaries (Zott & Amit, 2010). Complexity is a characteristic inherent to any system and therefore relevant for business models as the architecture of strategic choices as well (Zott & Amit, 2008; Zott, Amit, & Massa, 2010).

Complexity results from multiplicity, diversity of system elements, and relationships or connections between these elements (Gunawardhana, Suzuki, & Enkawa, 2015). In supply chain management literature (see e.g. Pathak et al., 2007), value creation networks have been characterized as highly complex due to the combinatorics that is related to the network and the dynamic change that takes place in these networks. In more general terms, business model creation leads to complexity based on the strategic choices and adaptions made in the development process. Since value networks operationalize strategy and business models, complexity affects the corresponding value networks. Thus, the complexity associated with business models needs to be made transparent and if possible quantifiable as part of the development or innovation process. Here, the distinction between the internal and external complexity of business models can be made (Gunawardhana et al., 2015). Additionally, the strategic positioning of companies in a

business value network, with a vertical and horizontal scope, needs to be acknowledged (Fjeldstad & Ketels, 2006; Huemer, 2006). This is of particular relevance in recent times, due to the growing complexity caused by hyper-competition and globalization (Onetti et al., 2012). The increased complexity makes business decisions more complicated and leads to the need for a systemic view of the company and its environment to effectively and efficiently foster value creation (Golinelli, 2010; Jones, 1999; Onetti et al., 2012). Consequently, the strategic positioning in the value network and the embeddedness in the supply network should be part of the business modeling process.

Besides these general assessments towards business models, complexity, and the necessity for addressing embeddedness in the supply chain, further scientific research supports the importance of this topic. A meta-study by Song et al. (2008) reveals that supply chain integration is one of the prominent universal success factors for new technology ventures (NTV) (see Chapter 2.2.1). The goal of this study is to get a more comprehensive view of factors that lead to success or failure of new companies because the numerous studies on the topic show controversial and fragmented results (Song et al., 2008). Based on an extensive literature review, Song et al. (2008) analyze 31 articles in detail, revealing 24 meta-factors of success of new companies. These meta-factors are assigned in one of three categories: Market and Opportunity, Entrepreneurial Team, and Resources. Remarkably, only eight of these 24 meta-factors have a homogenous positive significance and correlate to the companies' performances (see Figure 9).

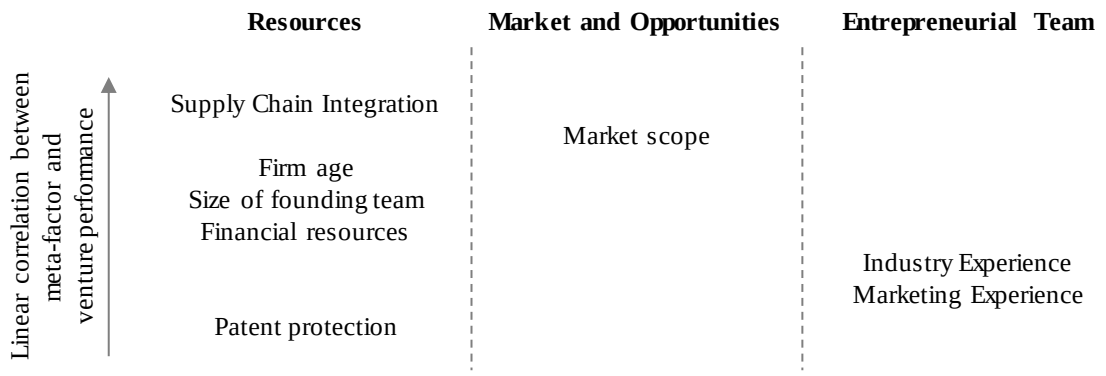


Figure 9 - Universal success factors for new technology ventures, based on Song et al. (2008)

On top of these universal meta-factors, the study reveals three situational significant success factors, namely:

- Company Type with the moderator subgroup sales concerning performance operationalization,
- R&D Alliances with the moderator subgroup mixed origin concerning venture origin,
- Product Innovation with the moderator subgroup mixed origin concerning venture.

While Song et al. (2008) expose many factors of limited or no significant impact on the business model of NTVs, their study reveals 11 strongly supported success factors. The most significant one is supply chain integration (Song et al., 2008). I argue that the embeddedness in the supply chain is not only a universal success factor for NTVs but impacts the business success of all kind of companies, especially when engaging in business in new industry domains (Metzger et al., 2015). This assessment is supported already by early business modeling research. E.g. Morris et al. (2005) are arguing to always consider the external fit to the business environment while making decisions on the business model on all levels (Morris et al., 2005a). Considering the more general findings on business models, complexity, and its consequences for operationalization in the value network, embeddedness in the supply chain needs to be taken into account in modern business modeling approaches. Additionally, tools and methods to analyze, evaluate and design the position of a company within its value creation network need to be provided. Hence, embedding the venture in a given or emerging value creation network is one of the entrepreneurial challenges that directly relates to complexity and demands the right tools and thinking to make a venture successful.

2.2.3 Discussion of selected business modeling approaches

Nowadays, there are several approaches towards business modeling. As mentioned above, there is still no common understanding of what a business model is or should be. In the following, I will introduce three of the existing business modeling approaches, which represent the variety of existing business modeling methods. Among these three approaches is Osterwalder and Pigneur's generic Business Model Canvas (Osterwalder & Pigneur, 2010). It is one of the best known and most popular methods with a focus on the nucleus of a company. Secondly, Gassmann's Business Model Navigator (Gassmann et al., 2013) will be introduced, an approach that focusses on few elements but offering a set of 55 business model concepts to choose from. Last, Lindgren's Business Model Cube (Lindgren & Rasmussen, 2013) will be presented, a new approach which takes into account that businesses may have different business models at the same time and that these business models may include cooperation with other companies. This introduction is followed by a discussion on if and how these approaches include the embeddedness in the supply chain, one of the key success factors for entrepreneurs (Song et al., 2008). And, as I argue, it is an important aspect for all business models.

Business Model Canvas (Osterwalder/Pigneur)

The Business Model Canvas is one of the best known BMI frameworks. Following Osterwalder and Pigneur (2010), a business model captures the rationale for creating, delivering and capturing value. Their business model framework consists of 9 building blocks (see Figure 10) which depict the strategic blueprint for the implementation of organization, processes, and systems. The canvas is a representation of the logic of how

a company intends to be profitable and covers the following four main areas and answers the corresponding questions:

- Customers: what customer (segments) do we want to reach?
- Offer: what do we offer and how do we deliver it?
- Infrastructure: how do we create the offer?
- Financial Viability: how can this be a viable business model?

According to Osterwalder and Pigneur's studies, BMI can have one of four goals. Companies or entrepreneurs either try to fulfill unanswered market needs or want to bring a new product, service or technology to a market. More far-reaching objectives are to improve or disrupt existing markets to the abilities of a company or to even create a new market by creating a new type of business. Varying in the degree of importance, all objectives are facing the need to find the right business model. Additionally, testing of a new business model, inducing of market participants to adapt a new business model, and adopting a new business model to the market response are critical. All of these aspects are especially challenging because they are addressed under uncertainty that needs to be managed. Every BMI project should be conducted while considering the particular situation of a company in a market. Nonetheless, there exists a number of so-called business model patterns, which have similar characteristics or behaviors. These patterns can be used as inspiration in the modeling process.

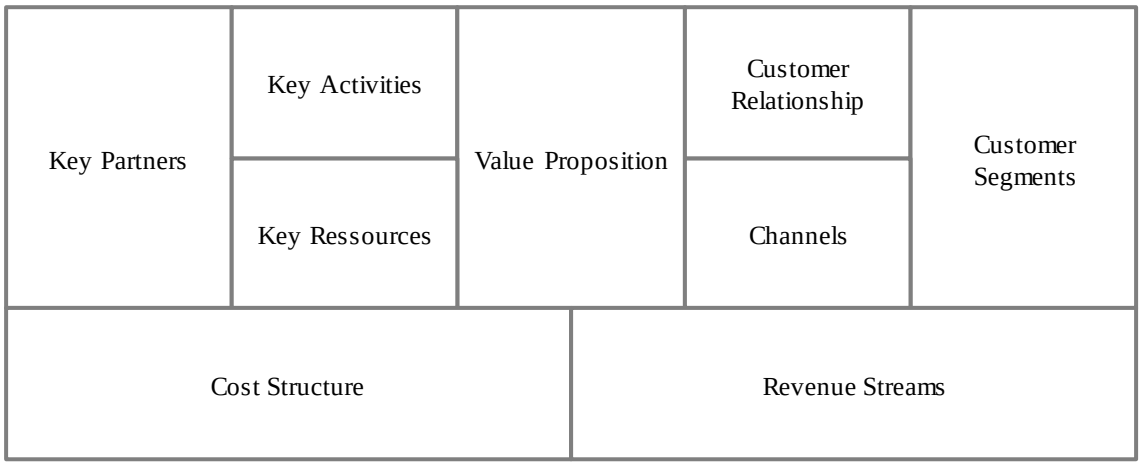


Figure 10 - Business Model Canvas (Osterwalder & Pigneur, 2010)

To conduct BMI based on the Business Model Canvas, Osterwalder and Pigneur (2010) suggest a generic five step approach. In the first step 'Mobilize', the basis for a successful BMI is being laid by setting up the project. Thereby, clarifying the objectives and assembling the appropriate team are of fundamental importance. This is followed by an intensive research and analysis phase with the goal to create 'Understanding' of the context in which a new business model will be implemented. In this step, it is critical

not to be biased of pre-commitment to certain ideas and not to lose focus of the research. Next, the actual business model 'Design' step follows, which comprises of four activities:

- Brainstorm, to generate some different ideas
- Prototype, to think the ideas through
- Test, to get feedback from outside experts or potential customers
- Select, to implement the best BMI idea

These four steps are highly important. Especially prototyping and testing enable to reduce uncertainty, because of the feedback loop, which is applied in these steps. This feedback allows for a much more well-informed decision on a future business model. The selection of an idea is followed by its 'Implementation', which involves setting up projects, milestone planning as well as organizational structures. The last step of their generic approach is to 'Manage' the new business model, meaning to adapt and modify according to market reaction.

St. Galler Business Model Navigator (Gassmann)

According to Gassmann et al. (2013), any business model constitutes of four interrelated dimensions. This simplified view allows for a more focused and thereby productive discussion compared to more complex approaches (Gassmann et al., 2013). Even though Gassmann claims simplicity, taking a closer look at the approach reveals that these four dimensions are divided into ten sub-categories, thereby matching the level of complexity of Osterwalder and Pigneur's Business Model Canvas (Osterwalder & Pigneur, 2010). Nonetheless, as a visual representation, Gassmann et al. (2013) choose the Magic Triangle (see Figure 11), incorporating the four dimensions that every business model has. In every dimension, there is a key question that the BMÍ process should answer:

- Customer: who are our relevant target customers?
- Value proposition: what do we offer to our target customers to fulfill their needs?
- Value chain: how will we realize the value proposition and what do we need for that?
- Revenue mechanism: how will we generate revenue?

A case of BMI exists if at least two of these four dimensions are significantly affected by change. To achieve BMI, the dominant logic of conducting business in a domain is the key hindrance. On the other hand, it is the key factor to achieve success as well. Following Gassmann et al. (2013) breaking with the old, prevailing way of doing business in a domain is the only way to create something new and innovative. The resulting new and innovative artifact will be new to that particular field, but not new to the world. The underlying logic of this view on business models is that there is a limited number of business models patterns, which

are applied in different contexts and situation. Therefore, creative imitation and recombination of these successful business model patterns from other domains is key to BMI.

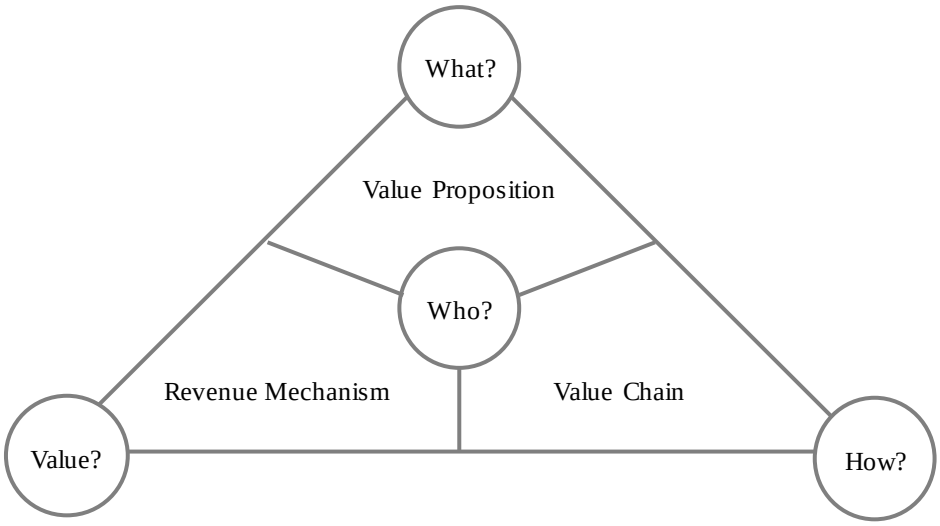


Figure 11 - The Magic Triangle of a Business Model (Gassmann et al., 2013)

Applying the St. Galler Business Model Navigator approach includes four steps. It starts with an initiation phase to analyze the existing business model and the environment, consisting of actors and influencing factors. Because many successful innovations are based on collaboration, the creation of an in-depth understanding of relevant actors in the ecosystem is imperative, consisting of the own company, customers, partners, and competitors. As part of this analysis, a visual representation of these actors in a network of relationships is of high value.

This description of the status quo is used in the second step, the so-called idea creation phase. Therein, the existing business model is compared to the general business model patterns, and potentially interesting approaches are being collected. Three basic strategies can be distinguished:

- Transfer of an existing business model into a new domain or industry
- Combination of business models and transfer to a new domain or industry
- Replication of successful business models and applying it to a different product area

These various strategies lead to a number of BMI ideas, out of which one needs to be selected. For this selection process, Gassmann suggests the Needs-Approach-Benefits/Costs-Competition framework (NABC) by Carlson and Wilmot (2006). NABC is a bottom-up approach. It takes into consideration the dimension of the customer perspective, internal perspective, value perspective and external perspective. Thereby the NABC is creating a 360° view on business or investment decision (Carlson & Wilmot, 2006), in this case, the business model idea selection.

Within the integration phase, step three of the approach, the selected business model is being developed for the specific situation of the company which is considering the business model situation. Of key importance is to respect internal and external consistency. Based on these design steps, the implementation step follows. Therefore, an iterative test and adaption phase based on trial and error is being suggested, before finally the market introduction of the new business model is being conducted.

Business Model Cube (Lindgren/Rasmussen)

Criticizing the lack of an empirically tested business model language, Lindgren and Rasmussen (2013) conduct a study to investigate the question which dimensions are common amongst any business model. Their answer to these questions is the Business Model Cube. The approach is based on seven generic dimensions (see Table 2) and incorporates the common denominators of existing approaches, adding dimensions they consider missing based on their study results (Lindgren & Rasmussen, 2013). Their work is influenced by Lindgren's earlier research, addressing the fact that a company can have different business models implemented at the same time. Each of them is addressing different types of business cases (Lindgren & Jørgensen, 2012).

Table 2 - Dimensions and related core questions of Lindgren's Business Model Cube

Dimension	**Description and related core question**
Value Proposition	Value offered to users and customers via products, services, processes of products and services (Physical, Digital and Virtual) *Core Question: What are our value propositions?*
User and Customer	B2B or B2C User and Customer, Users and Customers (Physical, Digital and Virtual), Chains od Users and Customers *Core Question: Who do we serve?*
Value Chain (Internal)	Value chain functions with primary (inbound logistics, operations, outbound logistics, sales and marketing, servicing) and secondary (business model innovation, administration, finance infrastructure, human resource management, procurement) functions *Core questions: What value chain function do we provide?*
Competences	(Core) Competences to conduct the value chain functions *Core Question: What are our competences?*
Networks	Networks (Physical, Digital and Virtual) with other businesses *Core question: What are our networks?*
Relations	Relations (Physical, Digital and Virtual) to other businesses customers, competences and networks *Core question: What are our relations?*
Value Formula	Turnover- Cost = Profit or other value formula than money *Core question: What are our value formulae?*

Within the Business Model Cube, Value Proposition is an important part of a business model and considers what value is offered to users and customers, who are represented by the second building block. The

internal value chains consider functionalities within the company to create and deliver this value, while the competencies building block represents the core competencies needed to conduct them. Another building block is dedicated to considering business networks of a company. The building block Value Formula describes what the potential profit or other value can be generated by a new business model. The dimension Relations has four sub-dimensions, all focusing on different types of relationships: relationships within the business model, relationships between the business model and other business models within the company, relationships between the business model and business models of other companies, and relationships between business models all outside the company (Lindgren & Rasmussen, 2013). Lindgren and Rasmussen do not provide a specific approach on how to apply these seven dimensions in the process of business modeling but state that they should be examined and can be looked at in more detail by dividing each dimension into components (Lindgren & Rasmussen, 2013). Nonetheless considering earlier works of Lindgren and Rasmussen the following steps take place in the process of BMI (Lindgren, 2012; Lindgren, Rasmussen, & Saghaug, 2013):

- Ideation
- Conceptualization
- Prototyping
- Market introduction

These steps are part of a continuous BMI cycle, which is necessary due to the fastening speed of change and the increasing complexity of business models. Therefore, BMI processes, including the corresponding models, need to allow for multi-BMI. This addresses the fact that vertical and horizontal BMI collaboration link business models to each other (Lindgren & Jørgensen, 2012).

Critical discussion of the approaches with a focus on the success factor 'Embeddedness in the Supply Chain'

These examples of different approach types towards business modeling all have their individual value for entrepreneurs and business model innovators. Osterwalder and Pigneur's Business Model Canvas is of high value to understand and consider different aspects of a business model by offering a simple approach to analyze business model ideas. Gassmann's St. Galler Business Model Navigator with the Magic Triangle as well as the research and analysis based on his concept provide an extensive list of generic business model approaches. These are of value to guide business model ideas at an early stage of the process. The Business Model Cube by Lindgren and Rasmussen (2013) with the dimension Relations, puts a new perspective on analysis and development on the topic by addressing the fact that a company can have business models that influence each other and that business models of other market participants affect the companies' business models. While being different in their methodology, all approaches have a basic process of how to address the topic of business model design. While these processes are mostly comparable, some difference in emphasis of prototyping and testing are made. Osterwalder and Pigneur as well as Lindgren

and Rasmussen stress the steps prototyping and testing that are followed by the subsequent selection of business models and the implementation. Gassmann, on the other hand, skips the prototyping and testing. In his process, after idea creation and selection of a business model, an initial adaptation towards the particular context of a company is conducted. The implementation phase, which includes testing and adaption in the early stages of this phase, follows next. Besides this difference in timing of the selection of the BMI, all approaches include some ideation and analysis phase, the design, and the implementation.

To enable a more detailed, structured critical discussion of the approaches, the V^4 business model structure by Al-Debei and Avison (2010) (see Chapter 2.2.1), is applied. The four dimensions of the approach are value proposition, value architecture, value finance, and value network (Al-Debei & Avison, 2010).

According to Al-Debei and Avison (2010), the value proposition dimension is characterized as the business logic of value creation for customers and all other parties involved. The aim is to offer customer-satisfying products and services. The dimension includes the sub-dimensions product/service, intended value segment, and target segment (Al-Debei & Avison, 2010; Al-Debei & Fitzgerald, 2010). The Business Model Canvas by Osterwalder and Pigneur (2010) covers this dimension comprehensively with the building blocks value proposition, customer relationship, channels, and customer segments. These building blocks are supposed to guide the business model innovator or entrepreneur by addressing the topics: quantitative and qualitative value of a product or service, the necessity of customer segmentation, and what customer relationship is to be maintained (Osterwalder & Pigneur, 2010). Five of the underlying elements of Gassmann's Magic Triangle cover this dimension, namely value proposition, customer, customer segments, stakeholders, and sales channels. These items are used to answer questions such as, who are my customers, are they segmented, what problems can be solved or wishes can be fulfilled, what value is thereby generated, and are there additional stakeholders that the company might generate value for (Gassmann et al., 2013). Thus, Gassmann covers this first value dimension extensively. The Business Model Cube by Lindgren and Rasmussen (2013) addresses this dimension primarily with two of the seven building blocks. The building block user and customer is used to define who a company serves by explicitly describing who the customers and users are and in what kind of business the company will be acting, business-to-business (B2B) or business-to-consumer (B2C). The building block value proposition, on the other hand, can be used to answer the question what a companies' value proposition is by specifying the value offered, product and services, and the delivery process (Lindgren & Rasmussen, 2013). Here, the Business Model Cube approach covers many key aspects of the value proposition dimension defined by Al-Debei and Fitzgerald (2010). In comparison to the approaches by Osterwalder and Pigneur (2010) and Gassmann et al. (2013), Al-Debei and Fitzgerald's approach is less exhaustive (see Figure 12). This is particularly the case for aspects channels and customer segmentation.

Dimension / Approach	Value Proposition	Value Architecture	Value Finance	Value Network
Business Model Canvas				
Magical Triangle				
Business Model Cube				

Figure 12 - Comparison of selected business modeling approaches, based on the V4 BM dimensions

Al-Debei and Avison's value-architecture dimension is concerned with the technological architecture as well as the organizational architecture and infrastructure to provide products, services, and information flow (Al-Debei & Avison, 2010). Osterwalder and Pigneur address this dimension with the building blocks key activities and key resources of their Business Model Canvas. Resources cover production facilities, human resources, intellectual property, financial resources, and more to create and offer value. Activities are concerned with the related actions that are necessary to generate and provide this value (Osterwalder & Pigneur, 2010). Thus, the Business Model Canvas covers all underlying sub-dimension of core resource, value configuration, and core competency that were defined in the V^4 business model concept (see). Comparably exhausting are the subelements of Gassmann's Magic Triangle. The subelement internal resources is concerned with resource allocation and resource configuration, answering questions of centralization vs. decentralization and how to allocate these corresponding resources accordingly. The element activities and capabilities, on the other hand, is concerned with the necessary activities to create and provide value. Additionally, questions concerning currently existing capabilities and appropriate, future activities and capabilities are raised and need to be answered as part of this subelement (Gassmann et al., 2013). For this dimension, the Business Model Cube by Lindgren and Rasmussen (2013) is as exhausting as the other two design approaches (see Figure 12). The building block (internal) value chain refers to primary and secondary functions in the sense of Porter (1985). The main functions are inbound and outbound logistics, sales and marketing, operations, and servicing. The secondary functions are BMI, administration, finance infrastructure, procurement, and human resource management (Lindgren & Rasmussen, 2013; Porter, 1985). The building block competencies is concerned with the required skills. In other terms capabilities, which are necessary to conduct the identified primary and secondary functions that are necessary to create and deliver value (Lindgren & Rasmussen, 2013).

The value finance dimension of the V^4 business model concept is concerned with revenue sustainability and improvement by managing cost, pricing, and revenue breakdown including total cost of ownership (Al-Debei & Avison, 2010). Osterwalder and Pigneur (2010) address this topic with two of their nine building blocks, namely revenue streams and cost structure. Revenue stream is concerned with the customers' willingness to pay and the pricing strategy (Osterwalder & Pigneur, 2010). Revenue mechanism is one of the core topics of the Magic Triangle by Gassmann et al. (2013). With the subelements cost-driver and revenue streams, most core aspects of the V^4 business model concept are addressed. Here, cost-driver can be used to analyze and define what related costs occur, what financial risk is included, and how this risk can be addressed. Revenue streams, on the other hand, is concerned with revenue sources, willingness to pay, and revenue structure (Gassmann et al., 2013). Lindgren and Rasmussen's Business Model Cube addresses this dimensions with the building block value formula. In contrast to the Business Model Canvas and the Magic Triangle, this approach does explicitly include other values than money. While turnover and cost are key elements of the value formula building block, they explicitly allow other value formulas than money (Lindgren & Rasmussen, 2013). In comparison, all three business model design approaches cover most of the core aspects of the V^4 business model concept. The only exception is the total cost of ownership issue that is not mentioned explicitly in any framework. Nonetheless, the approaches cover the dimension to much of its extent (see Figure 12).

Value network, the fourth dimension of the V^4 business model concept, is addressing how transactions are enabled by coordination and collaboration between parties and companies (Al-Debei & Avison, 2010). The building block key partnerships of the Business Model Canvas by Osterwalder and Pigneur (2010) is addressing this dimension. The key partnerships represent a network of suppliers and partners that enable the business model idea. Strategic alliances between non-competitors, coopetition alliances between competitors, joint ventures, and buyer-supplier-relationship are four distinct types of partnerships that can be differentiated, and that fulfill different key purposes (Osterwalder & Pigneur, 2010). While the Business Model Canvas addresses these topics, it is not made to primarily support collaboration efforts (Eschenbaecher et al., 2014). Within the Magic Triangle, partners are addressed as part of the value chain. According to Gassmann et al. (2013), part of the coordination along the value chain is to identify the most important partners and leading suppliers. Additionally, it should be distinguished what activities and what corresponding value they can provide. Even though Gassmann states that understanding and visualizing the eco-system of a company, including the relevant actors, is of high importance in the initiation phase, a tool to model this business environment including customers, partners, and competitors is not provided (Gassmann et al., 2013). The Business Model Cube addresses this dimension with two building blocks: networks and relations. The network building block is based on the perception that no business model is truly independent but that all companies are embedded in some network. These networks can be physical, digital, and virtual and should be determined as part of the business model design process. This is

complemented by the building block relations. According to Lindgren and Rasmussen (2013), four types of relationships can be distinguished, of which two have a special importance for the V^4 dimension value network: relations between the business model and other companies as well as relations between companies outside the business model. The former relationship refers to typical partnerships with other enterprises to enable value generation. The latter relationship refers to partnerships of other enterprises in the domain and their indirect influence on the companies' business model (Lindgren & Rasmussen, 2013). This perspective is unique amongst the three business model approaches under investigation. While all approaches cover the core of the dimension by addressing partnerships with other companies to enable the value creation, none of the approaches comprises its aspects exhaustively (see Figure 12). Especially, understanding the underlying logic of value creation in the domain based on roles and actors is not part of the focus of these approaches. Neither the Business Model Canvas nor the Magic Triangle address the business network as a whole. While the Business Model Cube with the relations building block puts some attention on the topic of overall value creation, network organization, and role assumption, it does not enable the business model innovator or entrepreneur to understand the value network dimension in the way that Al-Debei and Avison (2010) recommend. Therefore, compared to other dimensions, the value network seems to be underrepresented in these selected business model approaches (see Figure 12).

According to Al-Debei and Avison (2010), all four dimensions of the V^4 business model concept are of importance for a business model in certain situations (Al-Debei & Avison, 2010; Al-Debei & Fitzgerald, 2010). Looking at the selected business model design approaches under investigation, it becomes apparent, that the dimension value network is underrepresented within these approaches. This is worthwhile to notice because, as stated above (see Chapter 2.2.2), the embeddedness in the value network is the predominant success factors for entrepreneurs and an important aspect in today's more and more complex value creation networks. An example of how to overcome this underrepresentation of the value network and the integration into the supply network is the approach of Gunawardhana et al. (2015). According to them, the Business Model Canvas is an excellent tool for business modeling, which, unfortunately, puts limited focus on integration into the supply chain. While recognizing Osterwalder and Pigneur's' approach as comprehensive, evolved over time, and accepted in the scientific community, they still see the necessity to adapt this approach towards the needs of embeddedness in the supply chain (Gunawardhana et al., 2015).

2.2.4 Value Delivery Modeling Language

VDML has its origins in Information Systems and is a UML-specified approach for business modeling. Its first beta version was released by the Object Management Group in April 2014 (Object Management Group, 2014). It has been developed as a business modeling tool that intermediates between strategy and business processes.

The fundamental notion of VDML is the creation and exchange of value which is defined as

'a measurable factor of benefit delivered to a recipient in association with a deliverable" (Object Management Group, 2014, 2015).

It is remarkable, that value is not reduced to money, but incorporates other intangible values as well. Besides this extension of the value definition, VDML is especially appropriate to model distributed or shared value creation. This modeling of distributed value creation is not reduced to value creation between different parties within one company but can also be used to model cross-company value creation efforts in various levels of complexity. VDML incorporates some business modeling approaches (see Figure 13) such as the before mentioned Business Model Canvas or e3-value. This enables users to take on different levels of abstractions and views on enterprises and their business models (Object Management Group, 2014, 2015).

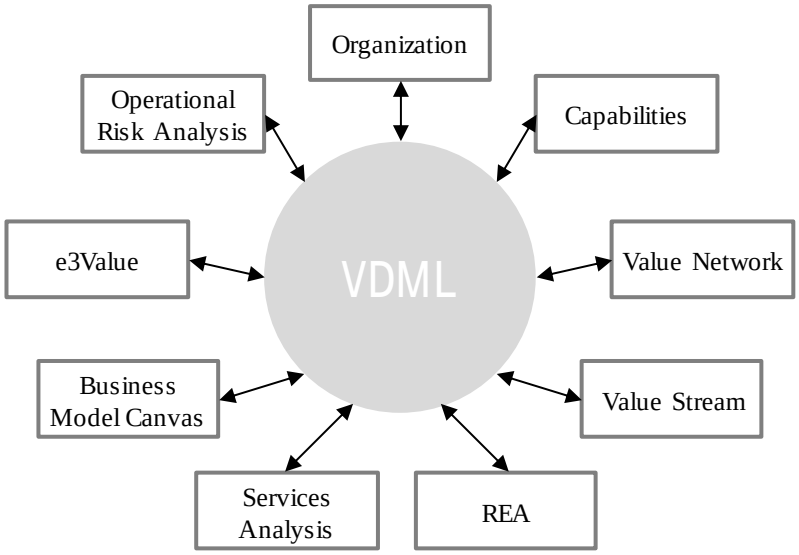


Figure 13 - VDML viewpoints (Object Management Group, 2014, 2015)

The initial two beta versions of the VDML specification incorporate only little graphical, normative notations. Instead, two published use cases aim at illustrating the graphical notation and the potentials of VDML applications (Cummins, De Man, & Berre, 2012). In additional publications, parties involved in the development and specification of VDML discuss the applicability of the concept for additional business modeling techniques, such as ServiceML or process innovation and business model description (Berre, Lew, Elvesæter, & Man, 2013; Berre, Lew, et al., 2013).

During the development of VDML, the parties involved aimed at addressing the following challenges of companies (Object Management Group, 2014, 2015):

- Robust modeling of tangible and intangible value streams
- Modeling of complex collaboration and enterprise networks
- Modeling of business activities of transformation in a highly fluctuating and unstable business environments
- Support the effective usage of distributed resources

Therefore, a variety of elements exists which can be assigned to different clusters. Those clusters do not stand alone but are connected, so that individual elements can be applied in several ones. Key clusters of VDML elements are:

- Value and value proposition: Values represent measurable benefits which are delivered to a recipient. A value can be a tangible or intangible, measurable asset. The value proposition formulates the corresponding level of satisfaction from the recipient's perspective, based on her preferences. Because preferences are not always stated explicitly, value propositions may represent estimates about the recipient's preferences.
- Capabilities and Activities: Capabilities are used to deliver products or services and are fundamental to create value by performing activities. Often, capabilities can be utilized for several activities or can be used to support other capabilities. Therefore, the definition of a capability taxonomy can be of value, to support consistency and enhance the possibility to recognize if and when the same capabilities are used by different organizations or organizational units. Performed activities create business items, e.g. information and thereby use or even consume resources.
- Collaboration: As the fundamental organizational concept, collaboration represents the interaction of participants within a system. These participants may be assigned to one or several roles to fulfill a specific, common goal. Therefore, a participant may be involved in several collaborations. Even though in general, every type of collaboration can be displayed, certain common types of collaboration are defined, the Business Network, which represents independent entities which engage in a marketplace. Others are Community, which represents loose associations of participants, working towards a common goal and OrgUnits, representing elements of an organization.
- Resources and Stores: Resources within VDML are being used or even consumed by performing activities. Resources are being held in stores until utilization. Reusable resources are stored in so-called pools, which is a particular type of store, and are being returned after usage.
- Measures: Measure is represented as a method to illustrate the value of characteristics of elements. Therefore, the Structured Metrics Metamodel (SMM) has been incorporated in VDML, which applies this approach already. In accordance with SMM, several measurements can be assigned to an element, depending on the context under observation. In VDML, characteristics represent the statistic measurement per unit of production.

While a software to perform simulation based on VDML does not exist, yet, the specification of VDML incorporates this approach already. In this context, specific VDML classes have been defined. E.g. for collaboration, value creation or different types of libraries which can be applied. With respect to simulation, the concept of scenario building in VDML should be mentioned. Depending on different environments or constellations, scenarios can be analyzed. Therefore, a default scenario needs to be defined which can be analyzed and compared to any number of other scenarios, differentiated by their particular context. Within a scenario, so-called delegation contexts may be applied, which represent different collaboration concepts, including the corresponding role assignment and specific measures.

At this early stage of VDML specification, the normative notation is limited to be graphical. VDML's authors expect it to evolve over time, including a normative notation via tabular displays (Object Management Group, 2014, 2015). Until today, tabular displays have not been complementing the specification, yet. Nonetheless, the specified types of diagrams have been applied in some first projects (Berre, de Man, Lew, Elvesæter, & Ursin-Holm, 2014; Berre, De Man, & Lindgren, 2013; Metzger et al., 2016). The specification contains eight diagrams types (see Table 3), which can be applied by the model designers according to their personal wishes or the needs and purpose of the model (Object Management Group, 2014, 2015).

Table 3 - Value Delivery Modeling Language – Types of diagrams and explanatory examples

Type of diagram	**Example of use**
Role Collaboration Diagram	Display deliverable flows of tangible and/or intangible goods and services within a business network
Value Proposition Exchange Diagram	Display the flow of Value Propositions between roles in a system to represent the flow of value added within a network.
Activity Network Diagram	Display of processes and the exchange of tangible and/or intangible goods within these processes
Collaboration Structure Diagram	Representation of an organization including the assignment of actors to roles
Capability Library Diagram	Hierarchical display of capabilities (parent – child) needed in an organization
Capability Heatmap	Display of the need for business innovation or transformation to offer capabilities
Capability Management Diagram	Display of capabilities by owning OrgUnit including possible supporting relationships
Measurement Dependency Diagram	Display of influence relationships between different measures and their corresponding measurements.

These types of diagrams can be used individually but can be combined to represent a coherent system as well. An example of the combination of diagrams is the use of Value Proposition Exchange Diagram (VPED) and Activity Network Diagram. As displayed in Figure 14, an Activity Network Diagram can be used to show

the same circumstances as a VPED. In this case, the Activity Network Diagram displays the situation in more detail and takes on a different view by focusing on the underlying processes of the value proposition exchange between two roles.

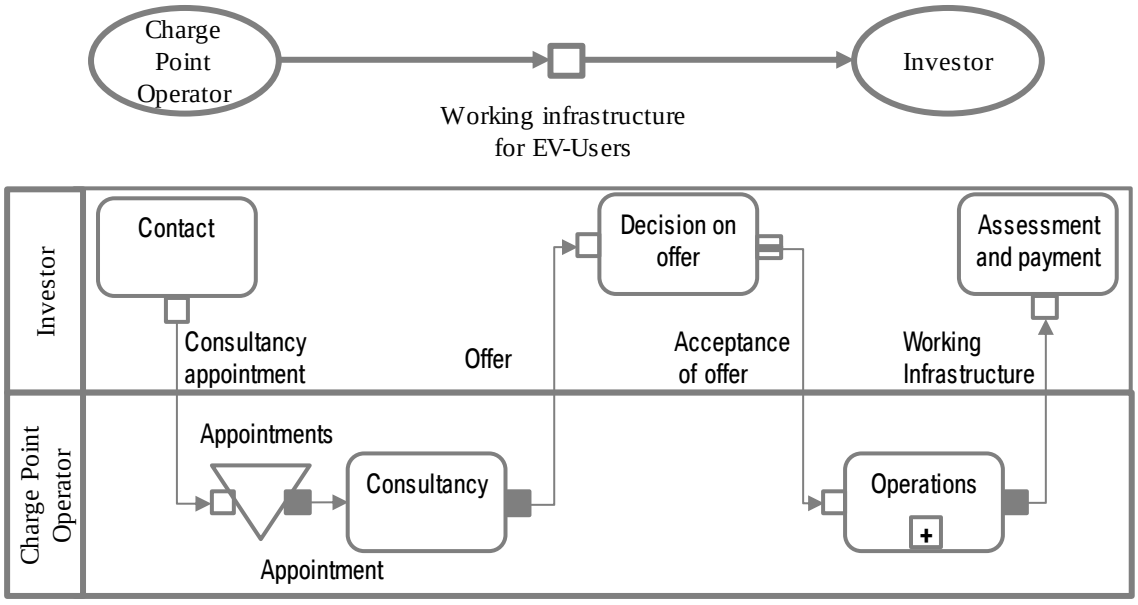


Figure 14 - Example of a combination of Value Delivery Modeling Language diagram types

In this example, the 'Investor' initiates the contact with a 'Charge Point Operator' (CPO). The 'CPO' consults the 'Investor' and makes an offer for the value proposition of ensuring a 'Working Infrastructure for EV-Users'. If the 'Investor' accepts the offer, the 'CPO' performs the operations, thereby creating value. This value of a working infrastructure is delivered to the 'Investor'. The process ends with the activity of assessment and payment by the 'Investor'. At this point within this work, I refrain from explaining the elements and shapes used in the diagrams in more detail. This will be done in Chapter 4.2. The fact that there is still no modeling software in the market to support the development process is challenging to keep consistency between interrelated types of diagrams.

The different types of diagrams of VDML address different levels of business modeling, reaching from very strategic perspectives by applying Role Collaboration Diagrams or VPED to more operational perspectives such as Activity Network Diagrams. When VDML diagrams are used correctly or if a (software) product based on the VDML specification is being implemented properly, an alignment to other modeling concepts can be reached. As displayed in Figure 15, VDML is aligned with the Business Motivation Model (Object Management Group, 2010) and Business Process Model and Notation (Object Management Group, 2011). Thereby VDML is acting as an intermediary between strategy and processes, which corresponds to my understanding of what a business model should do (see Chapter 2.2.1). VDML's link to strategy development is the fact that VDML can be used to support decisions towards strategic planning and

transformations as well as capability management by applying Value Proposition Exchange Diagrams or Capability Heat Maps. On the other hand, modeling of Activity Network Diagrams can build the basis for the modeling of repeatable, reliable processes via Business Process Model and Notation. Therefore, VDML acts as an intermediary and supports the operationalization of business model ideas because it represents a guideline for the development and definition of detailed, stable processes (Object Management Group, 2014, 2015).

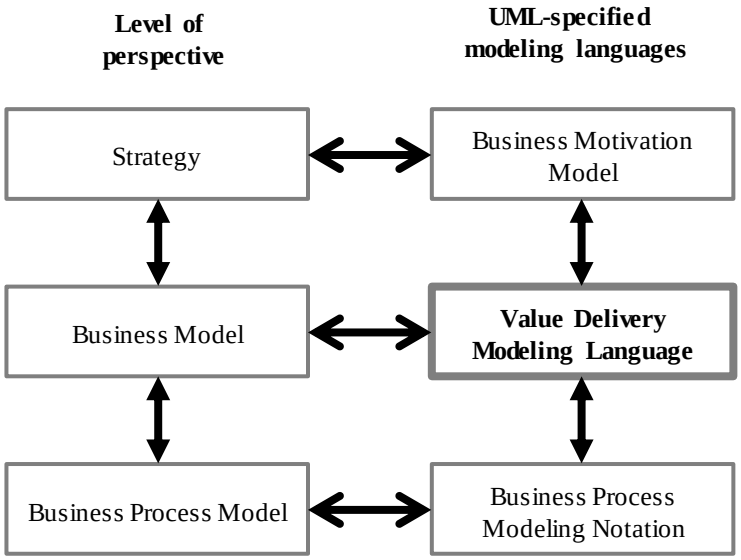


Figure 15 - VDML as an intermediary between strategy and business process modeling

Altogether, the specification of Value Delivery Modeling Language adds valuable approaches and perspectives to the existing business modeling methods. VDML incorporates or is in line with many popular business modeling approaches, e.g. the Business Model Canvas or e3-value. Besides this integration into the existing set of business modeling approaches, VDML shows the potential to fulfill the role as an intermediary between strategy and operations. Therefore, it is supporting the subsequent operationalization of business model ideas. In light of the recent scientific work, it is of particular interest that VDML offers opportunities to address the topic of positioning or embeddedness in the value network while modeling business model ideas and innovations.

2.3 Theoretical basis and methodology of ontology building

Ontologies are in widespread use in the area of Information Systems as explicit specifications of conceptualizations. They create a shared understanding within a domain and simplify the buildup and sharing of knowledge. This contributes to improved communication between people, organizations, and machines and thereby leads to an improved interoperability between systems (Ehrig & Studer, 2006;

Maedche et al., 2001; Uschold, 1996). Since the work of Osterwalder in 2004 (Osterwalder, 2004), ontologies gained importance in the field of business modeling as well and are in widespread use nowadays (Al-Debei & Avison, 2010). The following subchapters explain the origins of ontologies (see Chapter 2.3.1), guidelines for design (see Chapter 2.3.2), and their application in business modeling (see Chapter 2.3.3).

2.3.1 Origin, characterization, and aims of ontologies

The term ontology originated in philosophy and is the study of what exists, what features it encompasses, and what relationships exist amongst what exists (Hofweber, 2014). Special sciences such as biology or social sciences do research on specific classes of beings. In contrast, ontology as a philosophical discipline investigates what the common features of all beings are (Giaretta & Guarino, 1995). In other words, an ontology in its philosophical meaning represents a systematic account of Existence (Gruber, 1995).

Leaving the philosophical origin behind, the need for ontologies in a technical context has been arising in the field of Information Systems, especially knowledge engineering (Holten, 2003). Even though there still is no commonly accepted definition of ontology (Giaretta & Guarino, 1995), many researchers agree with the characterization by Uschold and Gruninger (1996) in which they describe an ontology as

'an explicit account or representation of some sort of conceptualization" (Uschold & Gruninger, 1996)

Thereby, a conceptualization is a system of categories representing a certain view of the world (Guarino, 1998), usually applied to a particular domain (Uschold & Gruninger, 1996). Such a view of the world usually includes an assortment of concepts, describing entities, attributes, and their interrelations (Uschold & Gruninger, 1996). A conceptualization is not dependent on any language, while an ontology needs a specific vocabulary representing an intended meaning (Guarino, 1998). While there is a number of characterization approaches and clusters of ontologies (e.g. Giaretta & Guarino, 1995; Guarino, 1998; Ullrich, Maier, & Angele, 2003; Uschold & Gruninger, 1996; Van Heijst, Schreiber, & Wielinga, 1997), four dimension re-occur: formality, genericity, subject matter, and purpose.

Beginning with the dimension of formality, the degree reaches from highly informal, e.g. loosely expressed in natural language, to rigorously formal with meticulously defined terms, formal semantics, and theorems. Of particular interest for this work is the semi-informal or structured informal level of formality. This type of formality is characterized by a restricted and structured form of natural language which allows for a high degree of clarity and reduction of ambiguity while not being bound to many formal aspects of ontologies with a greater degree of formality (Uschold, 1996).

The subject matter is a rather fuzzy characteristic because many sub-dimensions can be created. Nonetheless, according to Uschold (1996), three main categories can be distinguished. Category one focusses on the specific field of application, e.g. finance, automotive, or engineering and is also called a

domain ontology. The second category of subject matter is the problem solving, task execution or method specification. The third category is the subject matter of knowledge representation languages, also called meta-ontology (Uschold, 1996).

Depending on the context of an application, ontologies can have different purposes or aims and can contribute to several tasks. Following the categorization by Uschold and Gruninger (1996), ontologies are used to improve

- Communication between people and organization,
- Inter-operability between systems,
- System engineering benefits in the aspects of reusable components, knowledge acquisition, improved reliability, and specification.

An improved communication builds the basis for an improved interoperability and systems engineering. Ontologies aim at the reduction or even the elimination of conceptual and terminological confusion, enabling a common, shared understanding. Thereby, the ontology acts as a unifying framework for different perspectives of people with diverse backgrounds and creates a shared understanding of a system and its objectives. Such a common understanding can, in turn, increase interoperability among systems by facilitating the translation between different methods, languages or software tools. Furthermore, system engineering benefits from a shared understanding. Based on a shared understanding by various stakeholders with different backgrounds, specifications for IT systems can improve consistency and diminish the lack of ambiguity. The creation of formal encoding based on shared understanding can increase reusability and may even allow the automation of consistency checking to improve the software reliability (Uschold & Gruninger, 1996).

Genericity refers to the level of reuse in different situations and is related to the category purpose. Highly generic ontologies, also referred to as upper-level or top-level ontologies, are applied to structure broad aspects of human knowledge (Uschold, 1996). The defined concepts in a generic ontology are useable amongst many fields and usually define states, events, or processes (Van Heijst et al., 1997). Specific ontologies, on the other hand, are developed for particular applications (Uschold, 1996). The application ontology typically consists of a mix of concepts from more generic ontologies. Additionally, method or task specific extensions might be implemented, preventing reusability of the ontology outside its intended application (Van Heijst et al., 1997). Chapter 4.3 characterizes the ontology used in this research project.

2.3.2 Process of and guidelines for ontology design

As shown above, ontologies can have many different characteristics (see. Chapter 2.3.1). Nonetheless, according to Staab (2002), the general process of ontology building can be explained along the knowledge-

meta-process. After an initial feasibility study, the subsequent four steps are part of this process (see Figure 16): kickoff, refinement, evaluation, and adaption as well as extension.

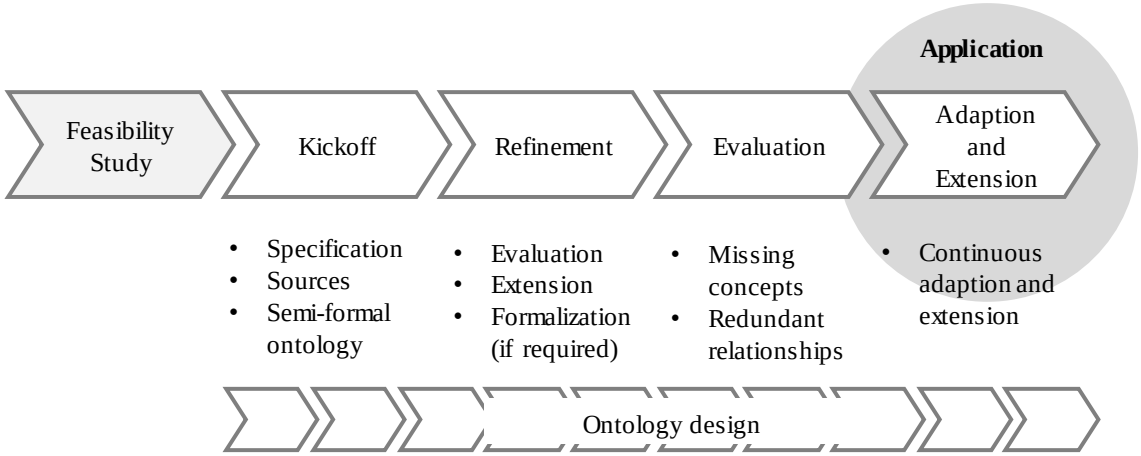


Figure 16 - Ontology development along the knowledge-meta-process (Staab, 2002)

The kickoff step is conducted to define a specification, identify knowledge sources, and develop an initial semi-formal ontology description (Staab, 2002). These goals are in accordance with Uschold's unified methodology of building ontologies, which starts with identifying purpose and scope of an ontology which leads to informal concepts and terms (Uschold, 1996). Consecutively, the goal of the refinement step is to evaluate and extend the ontology description, followed by, if suitable, the formal ontology. This is followed by the evaluation of the ontology to determine the necessary set of concepts, rules and, and relations (Staab, 2002). Thereby, some general criteria such as avoiding redundancies or recognition of implicit redundancies can be applied. Additionally, depending on the project, specific techniques, e.g. checking the ontology against its purpose, can be applied (Uschold, 1996). In case the evaluation shows inconsistencies, the ontology developer needs to return to step two of the process and adapt the semi-formal ontology description. In case the evaluation step was a success. Subsequently, the step of continuous adaption and extension of the ontology begins, including the knowledge buildup and sharing. In the case of major changes, especially re-structuring of the ontology, it may be necessary to perform the steps of refinement and evaluation, again (Staab, 2002).

Applicable to all these steps of ontology building, some general guidelines have been introduced by Gruber (1995) and Uschold (1996). Some of them are implicitly part of the process description by Staab (2002) presented above. For the design of ontologies, the following three guidelines developed by Gruber (1995) should be considered significant (Uschold, 1996):

- Clarity, in the sense of minimized ambiguity.
- Coherence, in the sense of internal consistency.
- Extensibility of the designed ontology.

The clarity guideline states that definitions should effectively communicate the intended meaning and be objective. While formal encoding can be conducted, definitions should be documented in natural language. Examples, positive just as negative ones, are a useful tool to achieve clear communication and to support a common understanding. The coherence guideline refers to the internal consistency of an ontology. As a minimal requirement, axioms should be logically consistent, and circularity should be avoided. Additionally, the ontology developers should avoid introducing unnecessary new terms. Instead, the usage of dictionaries and thesauri is recommended. The extensibility guideline refers to the ability to reuse and specialize the ontology without a required revision of existing definitions. Therefore, the ontology developers should be specific enough to use the ontology for the task intended, but not so precise that it cannot be utilized for any or few other tasks. Following these guidelines leads to a maximized subsequent reuse and extensibility (Gruber, 1995; Uschold, 1996).

Besides these three guidelines, Gruber (1995) introduces two additional ones. Developers of ontologies should aim for minimal encoding bias, meaning that a representation should not be used solely based on convenient notation or implementation. Additionally, only a minimal ontological commitment should be required. This guideline refers to the fact that parties using the ontology can specialize and instantiate the ontology as needed (Gruber, 1995). While Uschold (1996) doesn't discuss these two guidelines in his work, he names two different ones. According to him, the go middle-out approach and the right handling of ambiguity are relevant for identifying terms and definitions. The go middle-out approach is concerned with how to begin defining terms. Uschold recommends it because in his opinion, compared to top-down or bottom-up approaches, it minimizes the risk of missing commonalities and enables spotting inconsistencies. Therefore. it minimizes re-work and the corresponding increased effort in ontology development. For handling ambiguity about terms, he recommends to focus on the underlying ideas first and choose appropriate terms at the end of the ontology development process (Uschold, 1996).

Applying these three to seven guidelines for ontology design within a project will lead to the necessity of making tradeoffs among these criteria. This will happen, even though the guidelines do not contradict themselves, but can be applied to different aspects of an ontology. The request for clarity aims at the terminology. The ontological commitment, on the other hand, is about the conceptualization. Nonetheless, tradeoffs will, most likely, need to be made, as is the case in most design problems (Gruber, 1995).

2.3.3 Application of ontology in business modeling

Information Technologies (IT) has changed the way we do business today. IT facilitates value creation beyond company boundaries, e.g. by supporting the flexibility of product and service creation including their delivery, thereby creating value-added business networks (Kauffman, Li, & Van Heck, 2010). Therefore, the observed detachment of strategy and processes (Al-Debei & Avison, 2010) is not an IT-

domain specific phenomenon but is of relevance for all industries affected by IT. Hence, former IT-specific approaches, e.g. ontology building, disseminate from IT to business management.

Before ontologies in business modeling became prominent, researchers started to propose definitions and taxonomies, e.g. Timmers (1998) (see Figure 17). This was followed by a phase that was primarily concerned with defining the components and elements business models entail. In the third phase, these model elements were described in detail. Only in the fourth stage conceptual modeling of the components began, leading to meta-models and ontologies. These meta-models and ontologies started to be tested more rigorously. The last phase of this evaluation is the application of business model concepts (Osterwalder et al., 2005).

Prominent examples of business model applications are the before mentioned Business Model Canvas (Osterwalder & Pigneur, 2010), St.Galler Business Model Navigator (Gassmann et al., 2013), and Business Model Cube (Lindgren & Rasmussen, 2013).

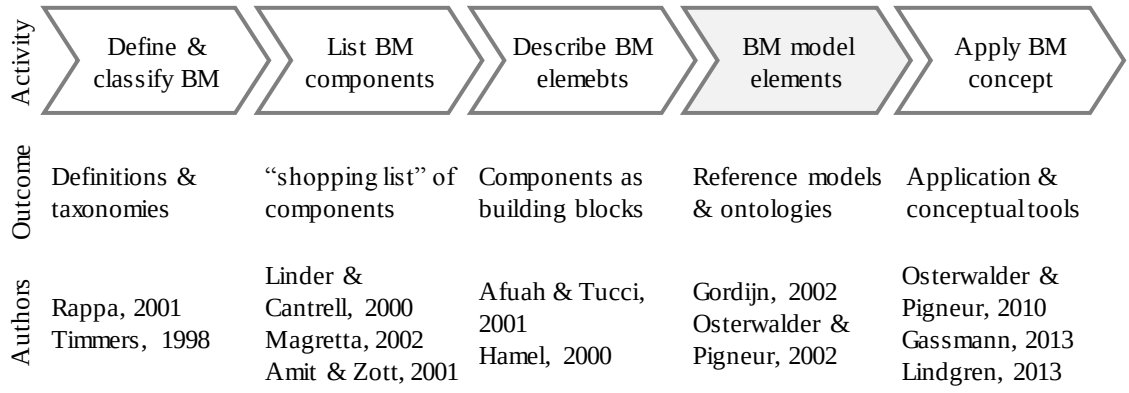


Figure 17 - Ontologies and the business model concept evolution, based on Osterwalder et al. (2005)

One of the first, scientifically acknowledged ontologies in business modeling is the eBusiness ontology by Osterwalder and Pigneur (2002) addressing business model issues in the internet era. Within their work, while referring to Fensel (2001), they define an ontology as a rigorously defined framework that aims at creating a common and shared understanding that enables communication between people and application systems (Osterwalder & Pigneur, 2002). This eBusiness ontology, consisting of the four pillars product innovation, customer relationship, infrastructure management, and financial aspects are the basis for the subsequently published general business model ontology (Osterwalder, 2004). Another well-known e-business ontology concept from the early 2000s is the e3-value ontology by Gordijn and Akkermans (2001). Their ontology aims at bringing together business and IT modeling by supporting the development of multi-enterprise relationships, operations requirements, and e-business scenario building (Gordijn et al., 2001).

Already in this early stage of business model ontologies, substantial common ground exists, especially concerning the purpose of ontologies: improved communication, interoperability, and knowledge acquisition to name a few (Gordijn, Osterwalder, & Pigneur, 2005). To further understand business model ontologies and their commonalities and differences, Andersson et al. (2006) developed a reference ontology for business models. Besides the aforementioned e3-value ontology and the business model ontology, they analyzed the Resource Event Agent ontology by McCarthy (1982) and its subsequent extension by Geerts and McCarty (2002). Also, to deepening the understanding of these ontologies, the reference ontology for business models can be used to map the different ontologies to each other, therefore enabling a transformation from one model to another (Andersson et al., 2006).

Since then, further efforts towards ontology building for business models have been conducted. In light of the recent work, I want to highlight one other business model ontology, because I applied its structure to analyze selected business model approaches (see Chapter 2.2.3): the V^4 business model ontology by Al-Debei and Fitzgerald (2010) explains the relationships between the elements of the business model dimensions of the V4 business model concept by Al-Debei and Avison (2010) (see Chapter 2.1.1). Due to the interdependency of the dimensions, it is neither sufficient nor efficient to address them separately. To visualize and describe the relationships between the dimensions, an upper ontology is used (see Figure 18). The value proposition dimension and its elements require the value network dimension because it facilitates it. Additionally, it is enabled by the value architecture dimension. The value network dimension provides input for the value architecture dimension that is enriching the value network. Additionally, the value network dimension affects the value finance dimension. While being designed for the value proposition dimension, the value finance dimension is additionally affected by the value architecture dimension (Al-Debei & Fitzgerald, 2010). Hence, every dimension of the concept is related to the other dimensions, and the ontology describes these relations, thereby creating transparency and a deepened understanding of business modeling.

In light of this work, it is important to emphasize Osterwalder's understanding of a business model ontology. Osterwalder defines his business model ontology, in compliance with and based on Gruber (1993), Guarino and Giaretta (1995), and Uschold and Gruninger (1996), as an explicit specification of a conceptualization. Thereby, the conceptualization is constraining the structure of a part of reality by intentionally defining a semantic structure including implicit rules (Osterwalder, 2004). Hence, it is a formalization of the elements, relationships, vocabulary, and semantics of a business model (Zott et al., 2010). In Chapter 4.3, I show how this general ontology understanding and the resulting business model ontology are applied within the VDAM approach.

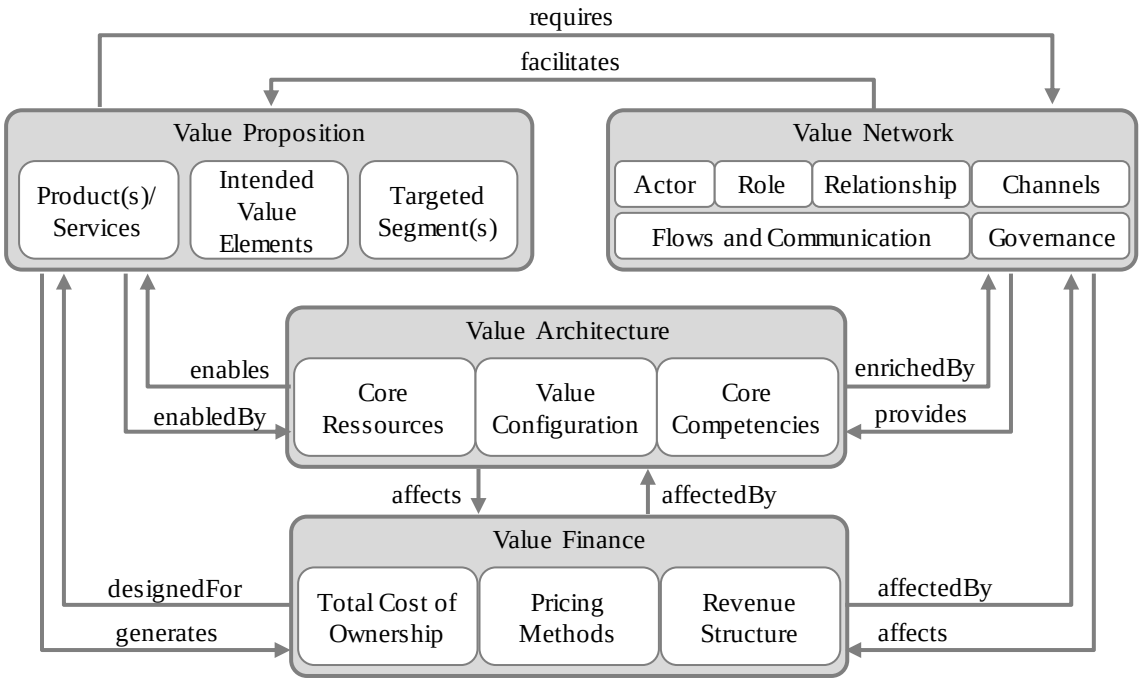


Figure 18 - The V4 business model upper ontology by Al-Debei and Fitzgerald (2010)

In conclusion, ontologies in business modeling play an important role. They describe the conceptual modeling and relationships between business model elements, thereby creating transparency and a deepened understanding. Altogether ontologies in business modeling aim to address the same issues as in their previous application in Information Systems (Uschold & Gruninger, 1996), namely insufficient communication between people and their organizations, limited interoperability, and missing re-use and knowledge sharing (Osterwalder & Pigneur, 2002). Today, they are part of many business model concepts to support these goals.

2.4 Implications for Value Delivery Architecture Modeling

The theoretical basis, displayed in the former subchapters, has an impact on the Value Delivery Architecture Modeling approach. The artifact developed as part of a design science research process (Hevner et al., 2004). The formal aspects of model creation (see Chapter 2.1.2), ontology design (see Chapter 2.3.2), and framework development based on case studies need to be considered along with the research project. The subchapter on business modeling (see Chapter 2.2) shows that VDML as an artifact has the potential to be used for a new approach to business modeling that focusses on the integration into the value network. As Chapter 2.3 shows, ontologies are another relevant artifact in business modeling. Business model ontologies are used for many years now and primarily aim at supporting transparency, thereby creating a common understanding. Subsequently, these findings are discussed in more detail.

As displayed in Chapter 2.1, a model is a representation of real, complex system and is being used to describe and solve specific problems. There is a variety of model types that can be classified according to Brandt's (2016) morphological box (see Figure 4). In light of the recent work, the resulting models of the VDAM approach are descriptive, qualitative, graphical models with deterministic information completeness. The models are static and are of homomorphic structure, simplifying the real world. While developing the approach and the corresponding models, it is important to comply with the GoM, especially the guidelines correctness, relevance, and economic efficiency. These guidelines need to be followed by the user of the VDAM approach. Nonetheless, the VDAM framework needs to ensure that the model designer can fulfill these guidelines. Hence, it is important to determine if the models created as part of the VDAM framework instantiation in the domain of fast charging infrastructure (see Chapters 5.1 and 5.3.3) fulfill these requirements. Within this research project, developing a new framework that focusses on a shared understanding of value creation and delivery can be considered part of theory building based on a single case study (see Chapter 2.1.3). While being part of a relevant research stream (Colquitt & Zapata-Phelan, 2007), certain challenges need to be mitigated. Research based on (single) case studies can create valuable insights and show interesting phenomena (Eisenhardt & Graebner, 2007) as long as the cases are not fabricated (Siggelkow, 2007). Additionally, other challenges such as an increased data bias need to be limited (Eisenhardt & Graebner, 2007) and universal claims based on the results of the case study shall be avoided (Siggelkow, 2007).

Looking at the topic of business modeling, some interesting findings are discussed, relevant for the recent work. First, business modeling is a relevant issue in research and gains further attention while business environments turn more competitive, complex, and turbulent (Onetti et al., 2012; Zott et al., 2011). Furthermore, as Zott and Amit (2007) point out, the prominent task of entrepreneurship is the design of business models. In the context of this work, entrepreneurship is defined as the process in which companies and individuals in companies explore and exploit opportunities by managing uncertainty in a proactive way (J. G. March, 1991). Hence there is theoretical and practical relevance to the topic of business modeling. Until today, there isn't a common understanding of a universal definition of what a business model is (Lindgren & Rasmussen, 2013; Zott et al., 2011), but there seems to be a consensus concerning the use of business models. As shown in Chapter 2.2.1, Al-Debei and Avison (2010) summarize the three primary purposes, as

- a conceptual tool for alignment between strategy and processes
- an interceding framework between technology and strategic goals
- Strategic-oriented knowledge capital for value creation.

Within business modeling, value creation across company borders is highly relevant and is addressed in most business modeling approaches by targeting relationships with suppliers, partners, and customers

(Morris et al., 2005a). In certain situations, e.g. for startups and NTVs, embeddedness in the supply chain, in other words, the positioning in the value network, is even the most prominent success factor (Song et al., 2008). As displayed in Chapter 2.2.3, leading approaches on business modeling cover the dimension of value network only to a certain degree and the positioning or embeddedness in the value network is not addressed directly. As displayed in Chapter 2.2.4, Value Delivery Modeling Language is a new promising artifact to overcome this challenge and to incorporate the positioning in the value network as part of the business modeling process. Additionally, VDML is developed as an intermediary framework between strategy and business process modeling. It provides different types of models and views, allowing different perspectives on a business model. These diagrams and views can be used individually or can be combined into a coherent system (Object Management Group, 2014, 2015). Thereby, VDML is supporting the before mentioned applications of a business model as an alignment tool, interceding framework, and knowledge capital store (Al-Debei & Avison, 2010).

As displayed in Chapter 2.3.3, ontologies in business modeling is a well-known concept for the last 15 years. Ontologies in business modeling aim at the same goals as ontologies in Information Systems (see Chapter 2.3.1), namely to improve communication between people, organizations, and systems. Furthermore, ontologies in business model facilitate re-use and knowledge sharing by creating transparency and a common understanding. As shown in Chapter 2.3.2, certain guidelines and requirements for ontology building need to be complied with. With regards to this research project, Uschold's remark towards formality is of particular importance. In his opinion, the use of informal but still unambiguous ontology is deemed sufficient for applications that aim at increasing communication between people and organizations (Uschold, 1996).

The theoretical basis of model creation, framework development, business modeling, and ontology building creates a set of requirements and guidelines to oblige with. Additionally, the chapter reveals the academic gap in business model research, namely the insufficient incorporation of the positioning in the value network as one of the prominent success factors for the successful implementation of business models. Overall, I deem VDML and semi-formal ontologies promising artifacts for reaching the goal of developing a new tool that focusses on a common understanding of value creation and delivery. These artifacts support the management of complexity and creation of a shared understanding amongst stakeholders. Thereby, VDML offers several visualization methods that allow to describe and manage complex value creation and delivery (see Chapter 2.2.4). Ontologies, on the other hand, enable common understanding and improved communication amongst stakeholders, supporting collaborative efforts (see Chapters 2.3.1 and 2.3.3). The application of these artifacts in VDAM will be introduced in Chapter 4, followed by the instantiation of the approach in Chapter 5.

3 Empiric explorative study in the area of fast charging infrastructure in Germany

The primary goal of the study conducted in 2014 is to analyze and derive new opportunities for viable (collaborative) business models for the installation and operations of fast charging infrastructure in Germany (see Chapter 3.1). Therefore, experts from different industrial sectors active in this new domain are interviewed (see Chapter 3.2). Their statements are coded following Mayring's QDA approach, leading to an extensive knowledge base for subsequent analysis and research (see Chapter 3.3). This knowledge base is used to analyze and interpret the experts' perspectives on the current situation as well as prospects of profitable business models (see Chapter 3.4). Analysis and interpretation of the experts' understanding of the value creation in this new domain follow next (Chapter 3.5). This Chapter ends with a summarizing conclusion of the findings of this empiric explorative study in the domain of fast charging infrastructure in Germany (see Chapter 3.6).

3.1 Background of fast charging infrastructure in Germany

As stated above (see Chapter 1.1) there are different fast charging infrastructure technologies available: the proprietary Super Charger Technology by Tesla as well as two technologies which are internationally standardized (International Electrotechnical Commission, 2014), CHAdeMO and the Combined Charging System (CCS). To allow for a sound legal protection of companies and therefore the security of investment in the field of charging infrastructure in Europe, the directive 2014/94/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 October 2014 on the deployment of alternative fuels infrastructure (European Parliament, 2014) has been issued at the end of 2014. To implement this directive in Germany, the BMWi publishes the so-called 'Ladesäulenverordnung' (Bundesministerium für Wirtschaft und Energie, 2016). Hence, in mid-2014, when the explorative study in the area of fast charging infrastructure in Germany has been conducted, no legally binding basis for fast charging infrastructure exists. Additionally, the CCS is a very new technology for which a first international standard, the IEC 62196–3 has just been released in June 2014 (International Electrotechnical Commission, 2014).

Therefore, only about 100 CCS chargers are installed and usable for EV drivers by summer 2014 (Nationale Plattform Elektromobilität, 2014). Part of this infrastructure are CCS chargers along the highway A9 in Germany, which have been used to successfully proof the importance and usability of these fast chargers for long distance traveling between Munich and Leipzig (Ramirez, 2015). Still, taking into account that in 2014 almost 13.000 km of highway are installed in Germany (Bundesministerium für Verkehr und digitale Infrastruktur, 2016) and DC charging is considered to be of particular significance for long distance traveling

(see Chapter 1.1), in average only every 130 km a DC charger is usable for public. Additionally, an equal distribution cannot be assumed, making the available network of DC-chargers even wider. With a limited range of most electric vehicles, this has to be considered insufficient. The lack of infrastructure at this point becomes even more visible by looking at the postulated number of 7.100 CCS-charge points in Germany, which is assumed to be sufficient to create a nationwide coverage with adequate fast charging station availability for EV users in 2020 (Nationale Plattform Elektromobilität AG 3, 2015).

There are several reasons for this lack of infrastructure in Germany. The before mentioned lack of legal protection is not encouraging to make investments in this area. Additionally, the number of EVs which are capable of charging DC with the CCS is very low. This low number of potential customers, coupled with very high initial investment costs leads to a minimal participation of companies in the installation and operation of fast charging infrastructure.

To solve this situation for EV- Users a government-funded project called 'SLAM – Schnellladenetz für Achsen und Metropolen' has been initiated at the beginning of 2014. The goal of this research project is to establish a network of 600 DC fast chargers in Germany, representing a minimal set of infrastructure to allow EV users to conduct long distance traveling and cover other charging needs. To achieve this, the government funds up to 50% of the investment costs. Besides lowering this investment hurdle, the project includes research on viable business models for the fast charging infrastructure (ika – Institut für Kraftfahrzeuge, 2014). As is visible in the partners of the SLAM project, companies and organizations from different industry backgrounds participate in this new domain. There are enterprises from the automotive industry involved in the installation and operations of fast charging infrastructure but also big utility companies. Furthermore, small local utilities take part in this government funded project. The charging infrastructure is developed and sold by companies with a manufacturing background and corporations from the service industry participate in several capacities. Thus, installation and operations of fast charging infrastructure represent a highly complex network of interaction between companies with diverse backgrounds and presumably different experiences and expectations towards this new domain.

In conclusion, the study is conducted in an environment of great uncertainty:

- Legal protection is foreseeable but not established, yet.
- Viable business models are not known.
- The low number of electric vehicles does not promise quick improvements.
- Government funded projects just started and have not improved the situation, yet.
- Companies from different industrial backgrounds are active in this new domain.

Not as a part of these government-funded project, but with the same intent, a study to determine viable business models for the installation and operations of fast charging infrastructure is conducted.

3.2 Setup and execution of the study

Interviews and the subsequent QDA are of particular importance if an in-depth analysis of a subject needs to be achieved. Especially if a standardized, quantitative data collection would not allow for a collection of the specific knowledge of experts. A limited number of experts in a particular field amplifies the importance of QDA (Glaeser & Laudel, 2010). Additionally, QDA allows elaborating new Information, which offers the opportunity to ask complex questions and enables some level of consistency concerning the results (Dresing & Pehl, 2013; Kuckartz, Dresing, Rädiker, & Stefer, 2008). The new domain of fast charging infrastructure in Germany qualifies as such a situation in which in-depth understanding needs to be achieved and only a few experts are available. Therefore, using qualitative research methods, interviews with 17 senior executives and top experts are conducted. These experts represent companies from different industry sectors involved in this new domain. The interviews aim at gaining information about the following subjects:

- Overall value creation in the new domain including the general layout of the value network
- Positioning of companies in this value network including their business models
- Profitability of business models of the companies active in this new domain
- Expected development of the field until 2020 including opportunities and risks

The experts are chosen by their ability to represent different types of companies, active in this new domain of fast charging infrastructure installation and operations in Germany. Six of the experts are from the automotive industry, another five from the energy sector. Three experts work for companies from the manufacturing industry, representing businesses that, amongst other things, develop and produce charging infrastructure. The remaining three experts work for enterprises of the service industry. Two of these companies were founded primarily to be active in the area of charging infrastructure while the third one broadened their service offer towards this new domain.

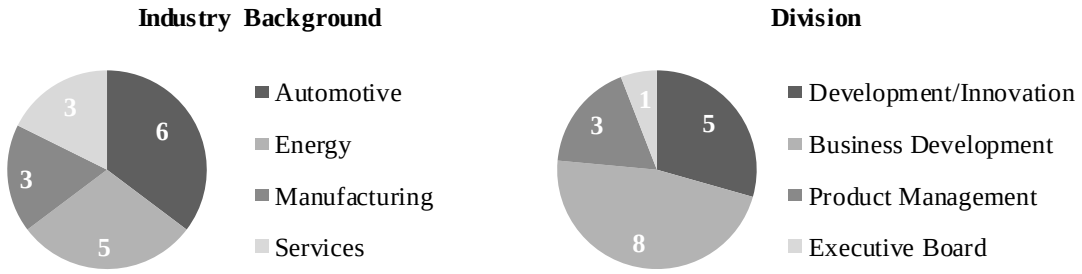


Figure 19 - Experts' industry backgrounds and company division affiliations

While anonymity is guaranteed to the experts, they agree to answer a short questionnaire to document their current position and responsibilities as well as their experience in the area of electric mobility and especially fast charging infrastructure. Besides working in companies from different industries, the experts also have different division affiliations in their companies. Most experts are active in the business development, product management or general management. Five experts have a more technical background, coming from Research & Development or (technical) Innovation within their companies. Although their industry background and division affiliation might be diverse, the responsibilities are very similar. Besides being responsible for the charging topics, especially charging infrastructure, within their companies, a major task for most experts is the participation at and representation of their enterprises in interest groups, consortia, or government funded projects (see Figure 20).

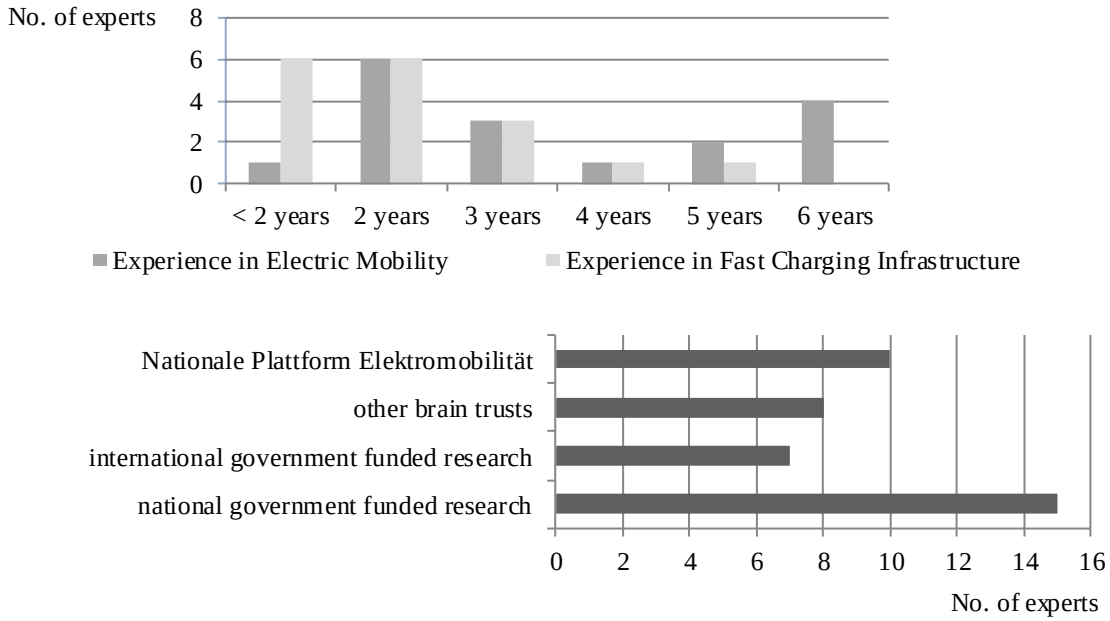


Figure 20 - Experts' electric mobility and fast charging infrastructure experience (August 2014)

In this capacity, the experts are in constant exchange with partners from other industries active in this new domain. Especially noteworthy is the experience of the experts in the field of electric mobility and fast charging infrastructure (see Figure 20). All experts, except one, have been working in the field of electric mobility for more than two years at the time of the interviews. One-third can even be considered being part of electric mobility in Germany from the very start, taking into account that the German government published their 'Nationaler Entwicklungsplan Elektromobilität der Bundesregierung' in 2009 (Bundesregierung, 2009). As mentioned before (see Chapter 3.1), fast charging is an even more recent topic within electric mobility, and many of the general requirements and the regulatory framework have not finalized by summer 2014. Therefore, it is even more valuable for this study, that almost two-thirds of the experts have been involved in this topic for two or more years, thereby representing in-depth

knowledge of this new technology. The long lasting domain affiliation, as well as their participation in brain trust, are proof of the interviewee's intimate knowledge on and their involvement in this field. This characterizes them as adequate experts in this new field (Meuser & Nagel, 2009; Trinczek, 2002).

For the interviews, the approach of semi-structured, problem-focused expert interviews is applied. With this approach, a set of guiding questions is developed. These enable the interviewer to cover all relevant areas of inquiry which are identified before the interviews are conducted. On the other hand, this approach allows the interviewer to adapt to the individual course of conversation with each expert by asking additional questions to inquire specific points into more detail if deemed appropriate to the interviewer. Furthermore, the order of the questions asked, which are defined in the guideline, does not necessarily need to be the same in every interview. Thus, the interview becomes less formal and might give the interviewee the feeling of a conversation. This environment leads to more detailed and open-hearted answers (Diekmann, 2007; Mayring & Brunner, 2009).

In this particular case, a set of 17 questions is defined[2], which is used to address different areas of business models (see Table 4), derived from business model literature, e.g. Osterwalder and Pigneur (2010), Lindgren (2013), or Gassmann (2013) (see Chapter 2.2.3). As displayed in Table 4, the questions can be mapped to the different topics of business modeling. Exemplary, this mapping approach between topics and questions is shown for two of these 17 guiding questions. Question 1 is verbalized as follows: 'Imagine a blank piece of paper. Which market roles in the context of fast charging do exist and which roles are occupied by your company?' The answer to this question is expected to primarily produce information about the roles and the positioning in the value network. Additionally, it is expected, that information about value propositions, channels, partnerships and the technical architecture might be revealed by answering this question. Question 9 is stated as: 'Do you need partners to deliver the value proposition? If yes, who are they, what are their tasks and how much value do they contribute?' Primarily, this question aims at deriving information about partnerships and the contributions of other third parties, including their activities. Furthermore, this question might disclose information about roles in the value network, value propositions, income streams and income allocation as well as underlying coordination mechanisms. It becomes apparent that questions about aspects of business models rarely touch one singular topic but might deliver information about many topics. This is not a surprise considering the interrelatedness of various subjects of business models (see Chapter 2.2.3) but can be considered a challenge in the analysis of the experts' statements within the QDA (see Chapter 3.3).

[2] The full set of guiding questions is displayed in the appendix

Table 4 - Mapping table of topics of inquiry and questions to cover these topics

		Questions															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Business model topics	Value Proposition	(x)		x					x						x		x	
	Activities		x		x										(x)			
	Ressources and Capabilities		(x)		x		x								(x)			
	Customer Segements			(x)		x												
	Channels	(x)			(x)			x										
	Income streams and mechanisms										x		x					
	Expenditure and Investments								(x)			x	x					
	Roles and Positioning in the value network	x							(x)	(x)			(x)	(x)				
	Partnerships	(x)								x								
	Contributions of others in the value network								(x)	x								
	Income allocation									(x)								
	Coordination mechanism								x	x								
	Technical Architecture	(x)											(x)			x	(x)	
	Growth/Expansion plans								x				x			x	x	x
	Risks/Opportunities								(x)				x	x		x	x	x

x = Question is expected to deliver key information about this topic
(x) = Question is expected to deliver additional information about this topic

The interviews are conducted between August 4th and September 11th, 2014, whereby three interviews are conducted face-to-face, the other 14 via telephone. The 17 interviews produce a total recording time of approximately 16 hours (see Figure 21). 15 of these interviews are conducted in German, the remaining two in English, due to the international background of these experts. The interviews are estimated to take about 50 to 60 minutes, which fits well to the average interview duration of 56 minutes. In one-third of the cases, the interviewees even grant more time than the estimated 60 minutes. Additionally, it is noteworthy that in two cases, the interview has to be held short due to the limited amount of time of the interviewees. One of these two experts is vice president of a company in the automotive industry, in the other case the interviewee is a member of senior management from an energy company. As Figure 5 reveals, the interviews held in English do not differ considerably from interviews conducted in German concerning the duration or the resulting length of the transcript.

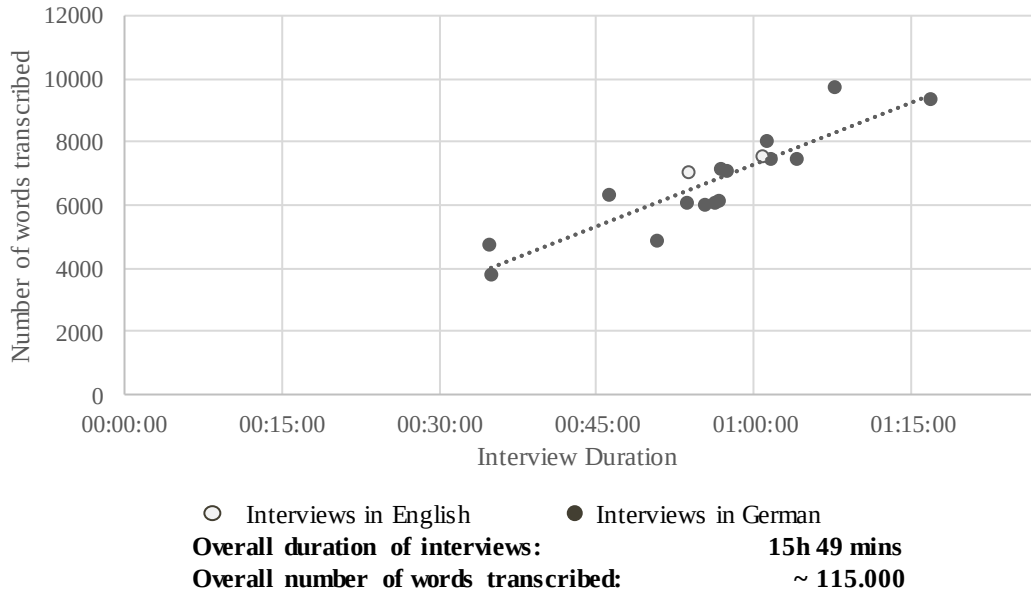


Figure 21 - Duration of Interviews and corresponding number of words transcribed

After conducting the interviews with this diverse group of experts with extensive knowledge in electric mobility and fast charging infrastructure the records are transcribed. The transcripts, which accumulate to approximately 115.000 words, allow for an extensive and detailed QDA based on the approach by Mayring and Brunner (Mayring & Brunner, 2009). In accordance with Froschauer and Lueger (2003) a simple set of rules for the transcription system is applied, e.g. timestamps are noted, participants are coded with 'I' for the interviewer and 'B1, B2, etc.' for the interviewees, and non-verbal statements such as laughter are indicated in round brackets.[3] The iterative coding approach and the results of this analysis are presented in the following subchapter.

3.3 Qualitative Data Analysis – material coding

To conduct the in-depth analysis of the expert interviews and subsequent interpretation of the extracted data, Mayring's (2010) QDA approach is applied (see Chapter 3.2). This general approach offers a structured and guiding process with nine steps (see Figure 22). The QDA process starts with the definition of the material, an analysis of the data inception and the formal characterization of the material (Mayring, 2010). In this research project, these first three steps can be described as follows. The material consists of semi-structured expert interviews which are conducted specifically for the purpose of subsequent QDA. Therefore, audio recordings of the interviews are made, and these records are transcribed (see Chapter

[3] See Appendix for the full list of the applied rules of the transcription system (Froschauer & Lueger, 2003; Kuckartz, Dresing, Rädiker, & Stefer, 2008)

3.2). Afterward, the direction of analysis needs to be defined. Examples of these directions are to determine the emotional condition of the interviewees, to judge the implications of statements towards a recipient or to focus on the content (Mayring, 2010). For this research, the latter approach is chosen, and the analysis concentrates on the functional content and the context of the experts' statements. In particular, statements concerning the value creation and delivery process, also known as the value network, are of interest in the coding process as well as the positioning of companies in this value network. Additionally, statements concerning the financial viability today and assessments towards future development including new types of business models are in the focus of the coding.

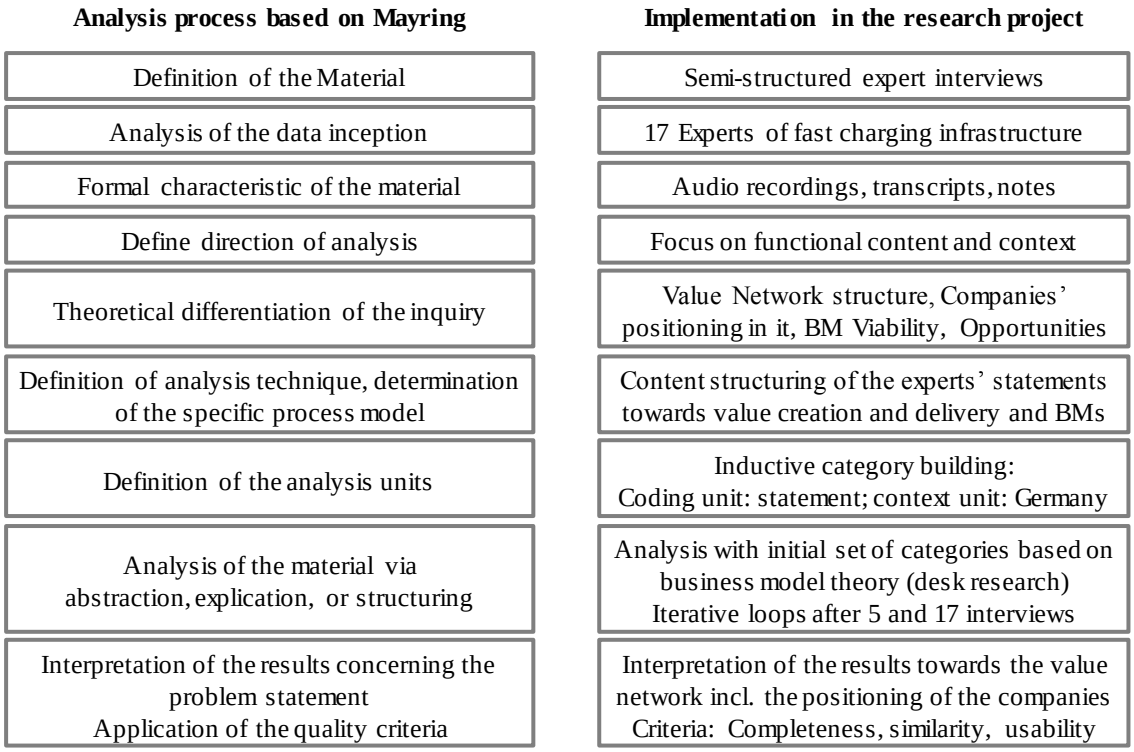


Figure 22 - The QDA process (Mayring, 2010) and its implementation in this research project

This knowledge base is used to close the before mentioned knowledge gap in the area of business model description and development in the field of fast charging infrastructure in Germany (see Chapter 1.2). Furthermore, it allows for assessing the success factor embeddedness in the supply chain (Song et al., 2008). This theoretical differentiation of the inquiry, step 5, is followed by the definition of the analysis technique (Mayring, 2010). In general, three types of analysis can be differentiated: abstraction, explication, and structuring (see Chapter 1.3). For this work, structuring was chosen to subsequently analyze and interpret the experts' opinions on business models as well as to model the overall value creation and delivery of the fast charging infrastructure domain. As analysis unit or coding unit, step 6, single statements or text fragments are defined. The corresponding code categories including a code

hierarchy are developed, applying the inductive category building approach (see below) while analyzing the material of 17 interviews with approximately 115.000 words. This seventh and eighth step of the process represent the actual coding and analysis of the material for which the QDA approach is applied and is followed by the final stages of interpretation (Mayring, 2010) which will be discussed in more detail in chapter 3.4 and 3.5.

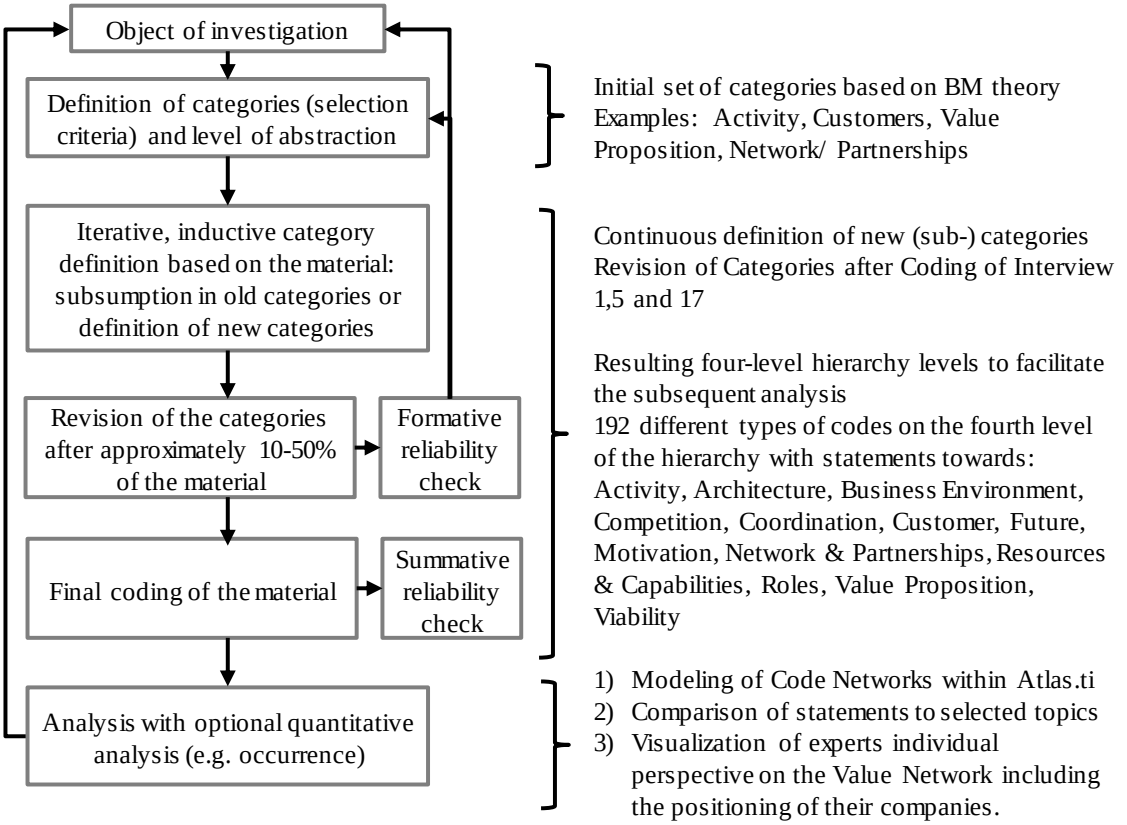


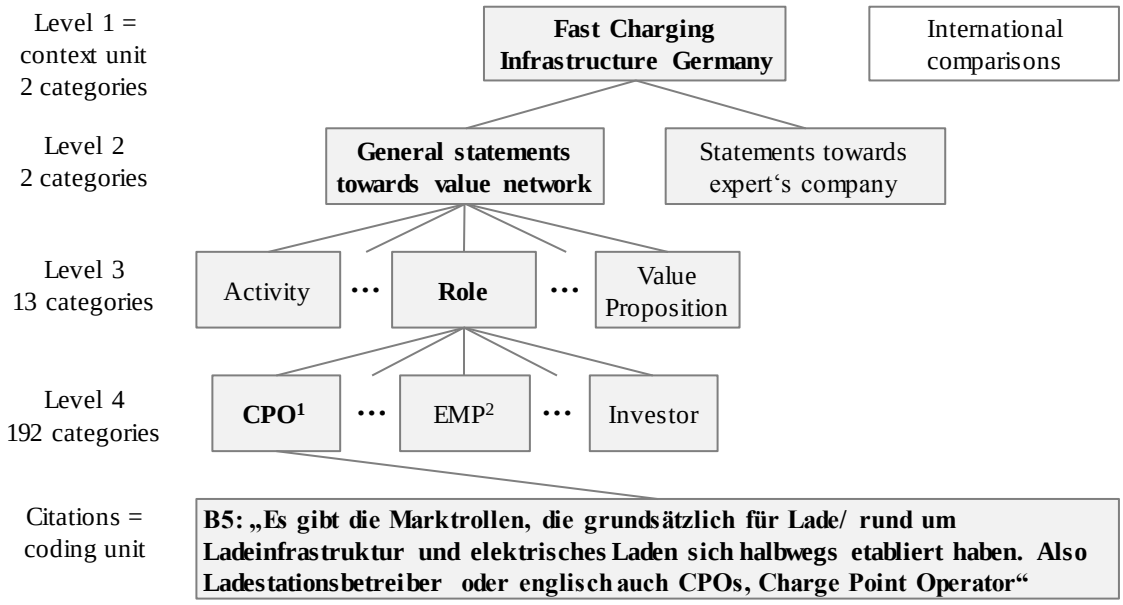
Figure 23 - The QDA inductive category building process and its application in this research project

Within this research project, the inductive category building process is applied (see Figure 23), due to the explorative character of the study (see Chapter 3.2). This process is characterized by a continuous definition of new codes, based on the statements derived from the material. Thereby it specifies steps 6 to 8 of the general QDA process by Mayring (2010) in more detail (see Figure 22). Based on the object of investigation, a set of initial categories is defined including the level of abstraction. In an iterative, inductive approach new code categories are identified, based on the material. Thereby, subsumption of new categories in old ones is possible, but also the definition of entirely new categories is feasible. These categories should be revised after 10-50% of the material and, if necessary, restructured to ensure the formative reliability. After the revision, the whole material should be analyzed anew. After a final round of coding, ideally, a summative reliability check shall be applied, e.g. by using an interrater reliability test or intrarater reliability test. The former of these tests measures the level of agreement if several raters code the material by

applying Cohen's Kappa (Cohen, 1968). The latter test uses Cohen's Kappa as well, but compares the level of agreement on codes applied by the same rater at different points in time (Gwet, 2008). Subsequently, the text, coded with a scientifically proven set of categories, can be analyzed, evaluated and interpreted.

The initial set of categories is developed by shortening and abstracting the questions defined in the guidelines for the interview (see Chapter 3.2). These questions are derived from the literature review (see Chapter 2.2.4), therefore building a scientifically sound basis for the coding process and subsequent analysis. This approach can be considered good practice in the inductive, iterative category building process (Kruse, 2011). This initial set consisted of 11 categories in alphabetic order: Activity, Architecture, Business Environment, Competition, Coordination, Customer, Future, Motivation, Network & Partnerships, Resources & Capabilities, Roles, Value Propositions, and Viability. Already the coding of the first interview reveals another three categories. The degree of category building increases substantially afterward. After the coding of five interviews, approximately 30% of the material, 126 code categories are established. After coding these five interviews, the first formative reliability check is applied, reviewing the created code categories. This is followed by a coding iteration on the first five interviews and the subsequent coding of the remaining 12 interviews. After the coding of all 17 interviews, another formative reliability check is applied, and the whole material is coded again, with the final set of 192 code categories (see Figure 25).

This large code category basis is part of a four level code hierarchy (see Figure 24). The top level of this hierarchy distinguishes between statements made towards the domain of fast charging infrastructure installation and operations in Germany and comparisons to other countries. For these latter statements, no further distinction within the coding is made. The comments concerning Germany, on the other hand, are divided into statements towards the general composition of this new domain and statements made on the experts' companies. Distinguishing between these kinds of statements already during the coding process facilitates the subsequent evaluation concerning individual business models existing in the market. For both level-two categories, further distinctions on the third and fourth level are applied. The third level is an extended version of the initial set of coding categories and contains thirteen categories. The fourth level of the hierarchy represents the 192 codes, applied to the material in the final coding, representing statements made by experts. Figure 24 displays an example of this code category based on a statement by expert B5. Her statement expresses amongst other things that a Role (Level 3) 'Charge Point Operator' (Level 4) exists. This is a general statement about the value network (Level 2) in Germany (Level 1).



[1] Charge Point Operator, [2] Electric Mobility Provider

Figure 24 - Excerpt of the code hierarchy including an exemplary citation

To further facilitate the analysis, the naming of the codes already includes the affiliation to the upper-level code categories. For example, the citation displayed in Figure 24 belongs to the code 'WSP_MR_CPO'. Another example of this kind of coding is the following quotation with the code 'IGM_MR_Ladestationshersteller':

'I: Ok. (….) Ich hätte noch kurz eine Rückfrage. Sie haben vorher ja diese vier Rollen benannt. Welche (…) erfüllen Sie davon? #00:29:49-0#

B8: Wir sind heute/ primär sind wir heute Hersteller Infrastruktur. Wir sind entsprechend im Bereich des sogenannte Second Level Service, Backend-Office. Dann wo es wirklich dran geht die echten Probleme. Das ist heute unsere primäre Rolle.'

The coding and hierarchy building is conducted primarily in German or with English expressions which are typically used in this new industry. In this context, WSP is short for 'Wertschöpfungsprozess' which translates to value creation process, and IGM is short for 'Individuelles Geschäftsmodell', meaning individual business model in German. MR is short for 'Marktrolle' which stands for market role. CPO is short for 'Charge Point Operator' and 'Ladestationshersteller' is German for charging station manufacturer. Additionally, all codes on the fourth level have a brief description to ensure transparency and a common understanding. Exemplary, the code IGM_MR_Ladestationshersteller is described by 'Rolle als Hersteller von Schnellladeinfrastruktur. Verantwortet Entwicklung und Produktion'.

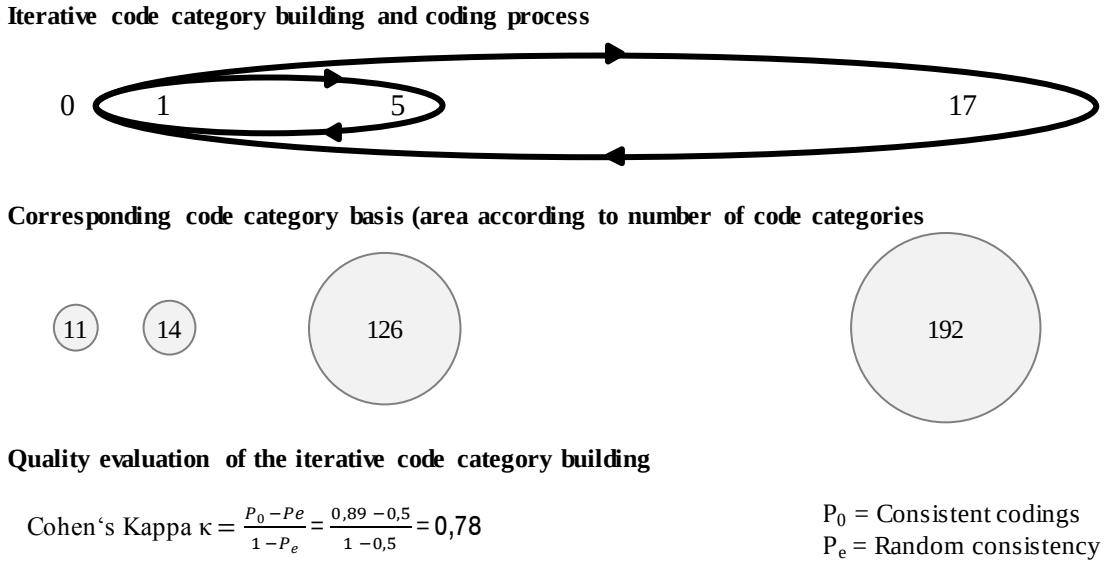


Figure 25 - Code basis development along the iterative category building and its quality evaluation

After introducing how the code hierarchy building, naming of codes, and their subsequent description is conducted, it is important to present the quality evaluation of the coding. To test the coding quality, a summative reliability test based on Cohen's Kappa is applied (Cohen, 1968; Gwet, 2008). Due to the complexity of the coding basis and to ensure scientific efficiency, some limitations to the test are applied. First of all, an intrarater test is applied, meaning that not another rater codes the material to compare the agreements on the coding subsequently, but the author codes the material a second time, approximately three months after the final coding of the 17 interviews. Additionally, the test coding is not applied to the fourth level of the coding hierarchy but to the third. And not all the material is tested but only one of the interviews. Nonetheless, the summative reliability test produces a result of 0.78 (see Figure 25). Following Landis and Koch,1977, the Cohen's Kappa for this interview can be considered as a moderate agreement, almost a substantial one (Landis & Koch, 1977). Taking into consideration that Greve and Wentura categorize a Cohen's Kappa above 0,75 as a good up to excellent result (Greve & Wentura, 1997), the summative reliability can be considered sufficient and the coding transparent and reproducible.

In conclusion, the elaborate coding of the material, based on the iterative, inductive category building process by Mayring produces an extensive knowledge base. 192 code categories are developed and applied to the material, leading to more than 1000 quotations. The following two chapters are dedicated to describing the subsequent analysis, evaluation and interpretation of this knowledge base, answering the problem statements concerning the value network of the new domain fast charging infrastructure including the current viability of business models and their prospects.

3.4 Qualitative Data Analysis – results concerning profitability

Goal of the coding is to generate a knowledge base to gather information about the value creation and delivery in this new domain as well as to find out about what roles are taken by different companies. Additionally, information about the viability of existing business models as well as future prospects is collected (see Chapter 3.3). The before mentioned coding hierarchy allows, that not only general statements about these topics can be used to evaluate and interpret the general situation in this new domain, but specific statements towards the experts' companies can be used as well (see Figure 26). The latter comments can be interpreted as a particular implementation or case within the general setup. This approach leads to a broader knowledge base concerning the overall situation in the domain. Moreover, this approach furthers consistency between these two views on the issue, because implicitly, the cases of companies are being considered for the description of the general setup.

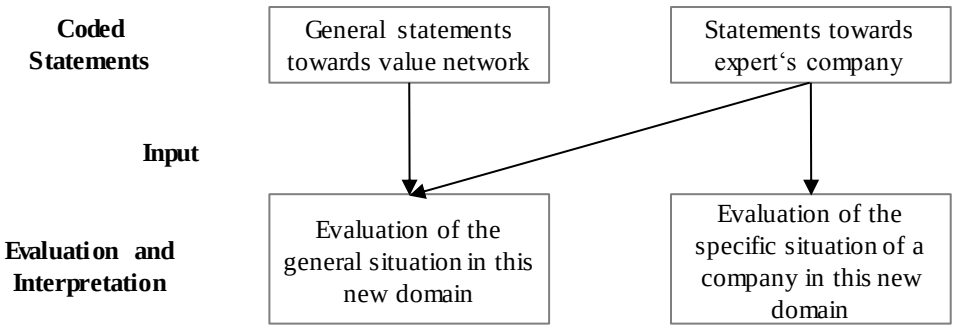


Figure 26 - Statements to specifics of experts' companies are input for the general situation

Starting with the analysis of profitability, a number of aspects are to be encompassed (see Figure 27). Firstly, statements concerning the cost structure for installation and operations of fast charging infrastructure are assessed. Complementary, statements concerning (potential) income streams are analyzed and their impact on profitability is assessed. Then, the conclusion towards profitability based on these two factors is compared to direct statements about the current situation about profitability in the new domain. Analysis of the statements towards the future prospects of business models include direct statements on if a given business model will be profitable. Besides this assessment, the experts' statements are analyzed and interpreted on how to improve the situation. Last, an evaluation about additionally motivating reasons for participating in this new domain is conducted.

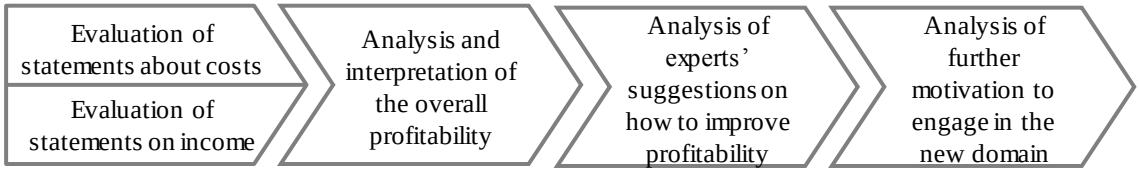


Figure 27 - Steps of analysis and interpretation of the experts' views on profitability

Beginning with the experts' views on costs in the new domain, data analysis reveals that to most experts, installation, hardware, and the subsequent operations are the primary cost drivers in this new domain (see Figure 28). Thereby, all experts mention installation and state that this factor is the most unpredictable one because it varies a lot from location to location. Within these installation costs, efforts for civil engineering and necessary grid integration take the biggest part. For instance, expert B2 states:

'B2: Das meiste Geld ist Projektierung und Tiefbau. Das ist teuer. Selbst jetzt bei einer Schnellladestation 50 kW. 25.000 € für die Ladestation macht nicht die Hälfte der Kosten aus.'

And expert B5 explains in more detail that due to the high electric power of the fast charging stations, sometimes not the closest electrical network node can be used. This needs to be checked onsite and can if another node has to be used, the installation cost are increased considerably:

' B5: es geht da im Endeffekt um Kabellänge oder um Grabenlänge. Und das ist also pro Meter dann x Euro. Und weil wir hier dann vielleicht durch/ aufgrund der hohen Anschlussleistungen dann vielleicht auch entferntere Netzknoten anfahren müssen, kann das schnell dann teuer werden. Also es ist auch nicht immer/ es ist schon planbar, aber es ist jede/ es ist nicht direkt immer vergleichbar. Man kann da nicht mit Pauschalkosten kalkulieren. Sondern/ Mit Durchschnittswerten natürlich schon, aber es kann sehr unterschiedlich sein. Von 5 Meter bis 50 Meter so ungefähr. Entsprechend hat man da schnell auch mal riesen Spannen in den Kosten drin.'

Hardware, the fast charging stations which are mentioned the second most, is expensive with approximately 20,000- 25,000 € per station according to expert statements. Compared to installation cost, these costs are more predictable. Other non-recurring costs mentioned by some experts are the cost for project planning and the actual space at the location of a charging station including the necessary parking space for the EV. Both cost categories are mentioned by only three of the experts (see Figure 28). Nonetheless, as expert B4 states, project management including the effort to obtain permission to install a charger takes many days of work and is usually not mentioned anywhere:

'B4: Also wenn ich jetzt die Vergangenheit mir angucke: Der größte Kostenblock ist der, der meiner bisherigen Kenntnis, nirgendwo aufgeführt wird. Das ist nämlich der Fall Projektierung. #00:33:05-8#

I: Was beinhaltet das alles? #00:33:08-2#

B4: Genehmigungen, Organisation, dass sie das machen dürfen. (….) steht nirgendwo drauf. Kostet viele, viele Arbeitstage. Wenn man das mal zusammenrechnet und diese, wenn sie dies mit normalen Arbeitsstundensätze, von Großunternehmen, wenn sie die internen Sätze da ran setzen, da kommen sie in riesen Dimensionen.'

Following the logic of expert B2, the space for a charging location including the parking space for the EV can be a considerable cost factor, depending on the location. If the location is to be considered a good location for a charging station, it can be considered a good location for other things as well. Therefore, nobody is just giving that space away for free:

'B2: Was in vielen Business Cases, die ich bislang gesehen habe, außer Acht gelassen wird, sind die Flächenkosten. Ich brauche, wenn ich eine DC-Station habe, nicht nur den einen Quadratmeter Grundfläche für die Station selber. Ich brauche immer einen Stellplatz. Denn Laden, über eine halbe Stunde, ist Parken. Und wenn ich einen attraktiven Standort für eine DC-Station habe, dann ist das auch ein attraktiver Standort für etwas anderes. (..) Und dann schenkt mir nicht irgendjemand die Fläche. Fläche ist teuer. Und in fast allen Business Cases, habe ich bislang die Flächenkosten nicht gesehen.'

According to the experts, these non-recurring costs accumulate to approximately 50,000 € per charging station in average, therefore putting a high burden on any business case for fast charging infrastructure.

The financial viability of business models for the installation and operations of charging stations becomes more critical when looking at the income streams (see Figure 28). The by far most mentioned income stream is charging events conducted by EV-users. Unfortunately, according to the experts, this income stream is inadequate to allow for profitability due to the limited amount of EVs in the market and therefore the limited amount of potential customers. Additionally, even though some kind of premium price can be asked for fast charging, the willingness to pay high prices for fast charging is considered limited. Expert B10 describes a scenario in which the price for electric range would be higher than using an ICE car and assesses that the customers would not accept that:

'B10: […]Es gibt Betreiber oder es gibt Modelle, die haben wir gemeinsam diskutiert, in unseren entsprechenden Kreisen, die eigentlich sagen, dass eine kWh 50, 60, 70 Cent kosten müsste, damit sie für den Betreiber kostendeckend ist, wenn er seine Infrastruktur alleine aus dem Stromverkauf decken will. Je nachdem wie man das aufdröselt. In meinen Augen wird das absolut unakzeptabel für den externen Kunden sein. Weil dann werden seine Kosten pro Kilometer höher sein als mit jedem Benziner oder jedem Fahrzeug.'

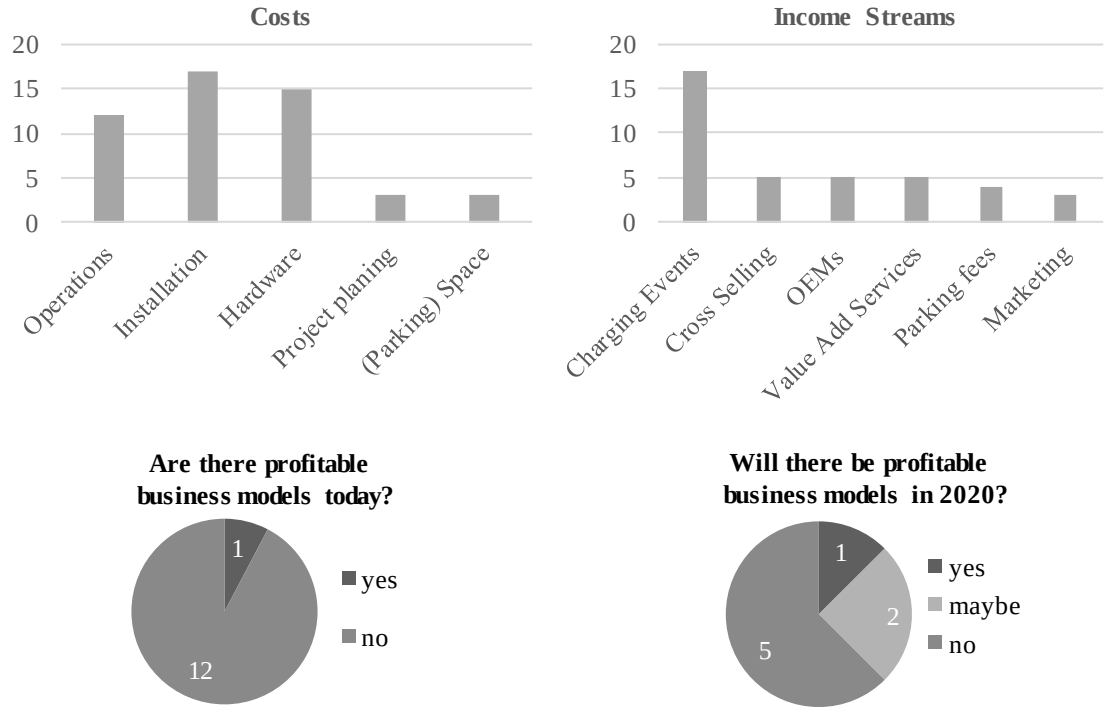


Figure 28 - Cost factors, income streams and financial viability in the domain

Other income streams mentioned by the experts can be characterized as demands, recommendations or ideas for cooperative, enhanced business models. For example, one expert suggests a cooperative business model in which a supermarket pays the charge point operator a marketing fee, because a CCS charger installed in front of the building creates a green and environmentally sustainable image for the supermarket. The CPO would cover the investments and operations and keeps the earnings generated by the charging event and the marketing fee:

'B1: […] Es kommt der CPO-Ladeangebotsbereitsteller kommt zum Supermarkt und sagt: ich geh das komplette unternehmerische Risiko ein. Ich brauch von dir den Ladepunkt. Und er macht jetzt hier einen Vertrag darüber, dass du über meine, dass ich dir noch ein grünes Image bereitstelle und dafür gibst du mir noch monatliches Geld dafür. So ein Marketingbeitrag. Aber ich bin derjenige, der die Ladesäule kauft und alles und an Wartung verantwortet.'

Other experts suggest, that the OEMs should bundle infrastructure access with the car sales. Due to the high prices of cars, a certain amount of this money could be used to participate in charging infrastructure installation and operations by giving this money to operators. Expert B9 puts it as follows:

'B9: […]wenn man das Ladeinfrastruktur nur als Teil eines Systemgutes versteht, im Sinne ich verkaufe Kunden, also das ist für mich eine reine klassische OEM Sicht. Ich verkaufe Kunden Fahrzeuge und gebe in

meinem Business Paket ein bisschen Infrastruktur oder Infrastruktursicherheit mit dazu. (…) Da kann man dann natürlich die Infrastruktur anders einpreisen in andere Preiskomponenten.'

Other experts agree with the necessity of cross-subsidizing offers but are highly skeptical towards their implementation and to what degree these ideas can contribute to a viable business case for the overall business model. Most ideas seem to be a bit farfetched and not realizable. And the remaining ideas which might create additional revenue streams are usually connected with additional investments:

B5: Also nach denen suchen alle. Wir auch. (..) Und wir haben da auch schon, kann ich verraten, sehr sehr viele Ideen gesammelt, gefiltert, bewertet. Am Ende ist es dann wirklich sehr dünn, was übrig bleibt, und auch realisierbar übrig bleibt. Und oft ist es so, dass vielleicht mögliche Zusatzeinnahmen dann, also wenn sie überhaupt funktionieren, dann erst mal auch wieder mit zusätzlichen Investitionen wieder verbunden sind.'

In conclusion, the analysis based on the expert statements concerning costs and potential income streams suggests that financial profitability is not given at the moment. This holds true even though there exist some ideas on how to create less unprofitable or even viable business models. The high initial, non-recurring costs surmount the income streams based on the charging events as well as additional services and offers. This analysis is consistent with the experts' direct statements on the profitability of today's business models in this domain. 12 out of 13 experts who answered this question say, that today's business models are not profitable. Nonetheless, experts see opportunities to improve today's highly loss-making situation of installation and operations of fast charging infrastructure. These opportunities are based on two topics: the manifestation of cross- subsidizing offers, e.g. cross-selling at the charging location, and in increased numbers of EVs as customers (see Figure 29). According to the experts, the unprofitable situation is not likely to change until 2020. Only half of the experts make statements concerning the potential financial viability of business models in this domain in the future. More than half of them state, that the business models will not be profitable by then, two of them see some potential and only one is convinced that business models will be profitable (see Figure 28). Therefore, only two experts are more optimistic for the year 2020 than they are today.

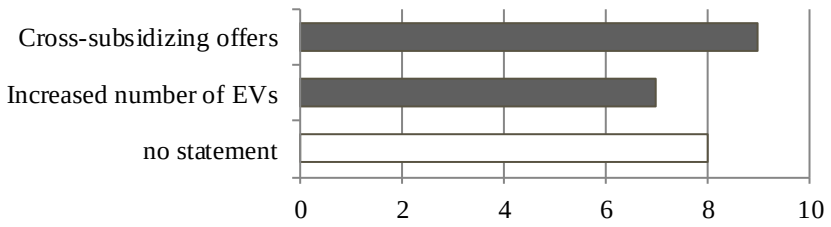


Figure 29 - Success factors for future financially viable business models

Based on these insufficient prospects on the financial viability of business models in the area of installation and operations of fast charging infrastructure, more than 2 out of 3 experts demand government subsidies for this domain. 12 experts from all industry backgrounds state that government subsidies are necessary and therefore they ask for direct financial aid to reduce the very high non-recurring initial costs. Almost half of these experts also ask that the demand for fast charging infrastructure should be strengthened by subsidizing the EV users as well (see Figure 30).

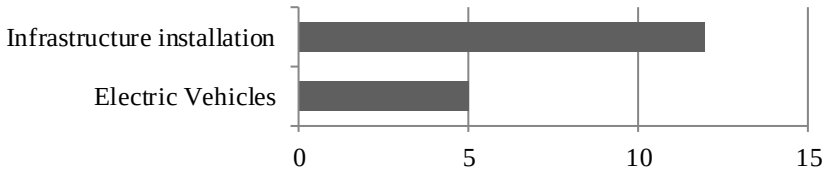


Figure 30 - Requests for subsidies for the domain

B14 summarizes the topic by stating that the so-called 'hen-egg-problem' of charging infrastructure can only be solved in synchronicity by addressing both topics at the same time:

'B14: aber dieses Henne-Ei Problem kriegen sie meiner Meinung nach nur im Gleichklang gelöst. Das heißt, sie müssen beiden tun. (…) Ja, weil sie haben ja immer die Situation, dass der Markthochlauf der Fahrzeuge muss passen zum Markthochlauf der Infrastruktur. Sonst haben sie nachher, sonst werden sie Fahrzeuge haben, die nicht laden können. Das ist blöd. Oder die andere Situation haben sie, die keiner braucht. Mindestens genau so blöd. Also deswegen muss das zueinander passen."

Besides the fact that the experts ask for financial aid, some experts state that some prerequisites should be met. One request is to not implement such support in government funded research projects due to the high amount of overhead generated by such projects. Instead, simple and lean government grants should be offered comparable to those that are provided for the wind and solar energy or roof insulation. One expert from the energy industry states it as follows:

'B7: Förderprojekte […] das ist ein wahnsinniger Overhead und eine wahnsinnige politische Abstimmungsarbeit, die da notwendig ist. Und ich bin ganz sicher, dass wenn man das, was an Stunden da rein fließt, geflossen ist, stattdessen monetär irgendwo ausgezahlt hätte. Also ganz einfach, jeder der Schnellladeinfrastruktur aufstellt kriegt, keine Ahnung, 50% bezuschusst. Ohne daraus ein Förderprojekt zu machen, sondern einfach, wie man halt auch Dachdämmung bezuschusst, ein staatliches Programm aufzulegen. Dann wäre man da viel schlanker und auch nicht und hätte man auch nicht mehr Kosten.'

The second request is that these government grants should be well thought-out, due to related risks of such funding. Especially matters of competitive restriction and sustainability of such investment including

the risk that companies might end their investment in this domain after the ending of government subsidies are of concern to these experts, as for example B10 states:

'B10: Die Dauer der Subventionierung habe ich noch nicht endgültig durchdacht, aber instinktiv habe ich damit meine Probleme, weil damit unter Umständen Wettbewerb im Markt verhindert. Wenn man noch nicht ganz genau weiß, wie dieser phase-out Plan liegt, dann kann das Probleme erzeugen, denn wenn zu einem gewissen Zeitpunkt der Subventionsgeber, also in diesem Fall die Bundesregierung, sagen würde, so, jetzt wollen wir das Ganze mal runterfahren. Und die anderen Marktteilnehmer sagen dann, dann steigen wir aus. Und letztendlich der Rest des Marktes, also die Fahrzeugnutzer dann im trockenen stehen würden, das sind Positionen, die muss man von Anfang an durchdenken.'

While financial viability in this new domain is not given today and, according to the experts, most likely will not be achieved within the next few years, the question arises why companies should be active in this new domain. Again, following the experts' opinions, main reasons to be active in installation and operations of fast charging infrastructure are company image, marketing reasons, and thereby the potential for customer retention, as well as the fact that the infrastructure is a key enabler for EV sales (see Figure 31). Another important motivation is the fact that infrastructure is considered a key enabler for electric mobility in general. This point is closely connected to the EV sales reason. Far fewer experts name potential future business opportunities as reasons for activities in this area. Two experts even mention altruistic political and social reasons such as prevention of air pollution as motivation for engagement. In accordance with these results, the experts from other industries than automotive, who name EV sales as a motive, argue that the automotive companies should invest in fast charging infrastructure, comparable to the efforts by Tesla with their proprietary system.

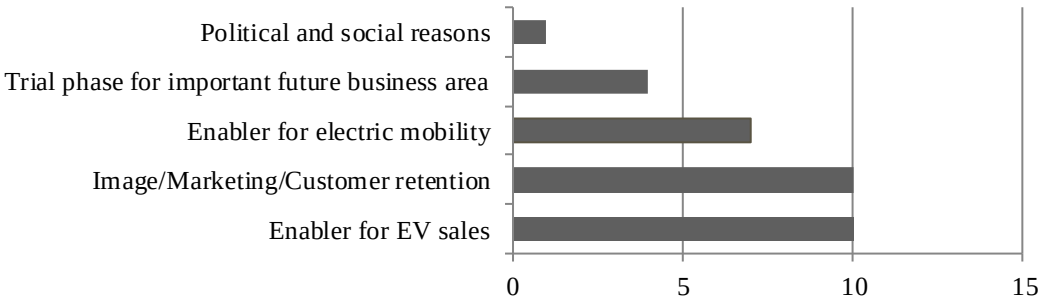


Figure 31 - Reasons for activities in the area of fast charging infrastructure in Germany

Exemplary, B15 as an expert with a charging station manufacturing background formulates it as follows:

'B15: The second I see, really, this is for the car manufacturers, like the Tesla model in fact. Like when you buy a Tesla you can have a free access to the superchargers. […] And that is probably a way that (…) some

car OEM may want to go in the future. […] So I see two business, two separate business models, the public one and the private one. And the private one I see at least two different ones, the shopping mall and the car OEM."

In conclusion, the new domain of fast charging infrastructure does not offer any profitable business models at the moment. According to the experts, the outlook for the next few years in not promising either. Business cases based solely on the sales of electricity will not have any prospects. Some experts see opportunities to improve the business cases for fast charging infrastructure installation and operations by applying enhanced business models based on cross-selling or bundling. Even though there might be some limited opportunities, the majority of the experts demand government subsidies to enable companies to be active in this new domain. Primarily, these funds should go to investors in charging infrastructure to effectively lower their non-recurring, initial investment costs. On the other hand, also the EV users should receive subsidies to buy electric cars, thereby increasing the number of potential customers at fast charging stations. According to the experts, additional reasons for being active in this new domain are mainly based on image and marketing as well as the knowledge that fast charging infrastructure is a key enabler for EV sales and electric mobility in general. As part of the next chapter, the value creation and delivery according to the experts will be displayed.

3.5 Qualitative Data Analysis – results concerning the value network

While the perspectives towards profitable business models in the domain of installation and operations of fast charging infrastructure are mostly consistent, the results concerning the experts' understanding of the value network are much more heterogeneous. Among other things, the experts are asked to name key roles and value propositions in this new domain. Besides directly asking for roles and value propositions to gather information about the value network, other questions reveal a lot of information about the experts' perceptions of how and by whom value is created and to what role this value is offered. Similar to the QDA concerning profitability, general statements about value creation as well as statements about the experts' companies can be used to analyze and interpret the experts' understanding of value creation (see Figure 26). The process of analysis and interpretation concerning the value network (see Figure 32) starts with a detailed analysis of the expert statements towards roles. Subsequently, the resulting roles need to be structured and assessed. The results are used to visualize the experts' views on the value delivery between roles in the domain, followed by an overall interpretation and comparison of the experts' understanding of value creation in the network.

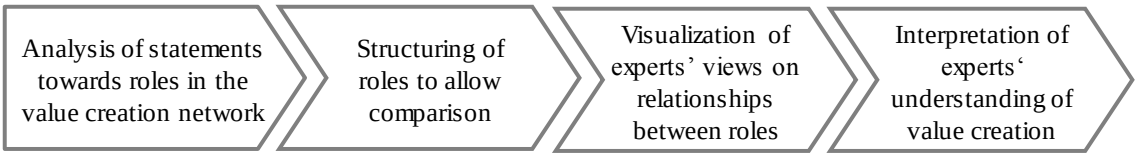


Figure 32- Process of analysis and interpretation of the experts' views on the value network

Starting the analysis on the value network by looking at the roles mentioned by the experts (see Figure 32) it becomes apparent that even on a very general level, there is a broad naming and understanding of roles. In the following, four statements are displayed concerning the role 'Electric Mobility Provider' (EMP) by experts from the automotive industry (B7), manufacturing (B8), energy (B9), and services (B16):

'B7: Der Dienstanbieter, der Ladedienstanbieter vor Kunde ist eben jemand, der den Kunden Ladedienstleistungen anbietet zu, zwischen ihm und dem Kunden festgelegten, Konditionen. Also das kann/ es kann sein, dass der irgendwelche Zugangskarten oder sonst was ausgibt und dann eben zu bestimmten Konditionen Strom (…) dem Kunden/ oder den Kunden laden lässt, sagen wir es mal so.'

'B8: Ist rein eine finanzieller Dienstleister, der entsprechend die Authentifizierung macht des Kunden, der die Kundenverwaltung übernimmt, den Kunden freischaltet. Dem Kunden ein Medium, wie zum Beispiel eine RFID-Karte zusendet oder eine PIN zusendet, damit sich der Kunde entsprechend, oder der Fahrer letztendlich, an der Ladesäule identifizieren kann. Und macht dann entsprechend die Abrechnung gegenüber dem Kunden, der geladen hat als auch gegenüber dem Investor, der dann entsprechend sein Geld haben will. Und gegebenenfalls auch die Abrechnung mit den entsprechenden Stromanbietern in den Regionen, in denen die Ladesäulen entsprechend stehen.'

'B9: Der Mobilitätsprovider ist, sagen wir mal, derjenige, der unter Nutzung der Infrastruktur dem Endkunden entsprechende Mobilitätsangebote unterbreitet. #00:03:12-8#
I: an der Stelle kurz nachgefragt: was beinhaltet das? #00:03:15-8#
B9: Das ist das ganze Spektrum, was wir so sehen. Von reiner kWh-Lieferung, von mir aus mit irgendwelchen,/ also transferiert anstatt kWh (…) Kilometer bis hin zu Kombinationsprodukten, verschiedene Dienstleistungen. Also man könnte ja neben dem Produkt Beladen auch irgendwelche Services koppeln. Also von mir aus bis zu einer Finanzierung von einem Fahrzeug. Oder was auch immer. Statt für verschiedene Service- Dienstleistungen die in irgendeiner Art und Weise das Kundenbedürfnis befriedigen.

'B16: Der Elektromobilitätsanbieter, das ist eigentlich derjenige, der vielleicht auch noch Zusatzdienstleistungen mit anbietet. Also wie zum Beispiel Endkundenhotline, Vertragsmanagement, Prepaid-Karten für die Kunden […] Also wir sind Elektromobilitätsanbieter. Sprich wir machen unseren Kunden ein Full- Service- Angebot rund um das Thema Elektromobilität. Das heißt konkret, wir verkaufen Ladestationen, wir verkaufen die Werbemittel dazu, wo sie dann eben Marketing machen können mit ihrem

Angebot, dass man eben bei denen Schnellladen kann. Es gibt monatliche Betriebs- und Serviceleistungen inkl. Endkundenmanagement, Callcenter-Leistungen.'

Within these statements, four different names for this role are mentioned: Ladedienstanbieter, finanzieller Dienstleister, Mobilitätsprovider, and Elektromobilitätsanbieter. While all experts agree that the 'EMP' offers some access to the infrastructure and billing to the 'EV- User', other aspects differ. In the value network described by B8, the 'EMP' is responsible for the billing towards the 'Investor' and the 'Energy Supplier'. B9 mentions that the 'EMP' offers value-add services of some kind of bundled products to the end-customer and B16 states that they are a 'full-service EMP' offering fast charging stations, advertising media, operations of the fast charging infrastructure, and more.

This example of the diversity of statements towards roles in the value network illustrates the necessity of additional steps of structuring, subsumption, and differentiation (see Figure 32). These steps allow creating a more consistent picture of the roles named by the experts so that an initial analysis is possible. Not all of these roles displayed in Table 5 are mentioned by every expert explicitly, but sometimes are derived from their statements on other topics and allocated as part of the structuring process within QDA (Mayring, 2010). Examples of the statements from which roles are derived are remarks about companies known by the experts, fictional use case descriptions, and accounts of customer relationships. Using again the statement by expert B16 concerning the 'EMP' role (see above) as an example, the actions which are undertaken to derive this mapping of roles mentioned by experts can be illustrated. The offers that B16 mentions can be compared to the statements of other experts. In this case, the offers 'fast charging stations', 'monthly operations services', and 'call center services' are mentioned by other experts as part of the value offer by different roles, namely 'Charging Station Manufacturer', 'Charge Point Operator', and 'Call Center'. Therefore, I conclude that these roles implicitly are part of the value network mentioned by expert B16, even though the corresponding offers are allocated in her statement to the 'EMP' role.

The concluding set of roles consists of 16 different roles mentioned by the experts. None of the experts mentions all of them and the number of roles voiced ranges from 7 to 11. All experts talk about the end-customer, the actual user of the fast charging infrastructure with an EV. The 'CPO', responsible for the operations of the charging station, is also mentioned by all experts as well as a party that makes the investment. Some experts do not make a distinction between these roles. For them, the 'CPO' role also makes the investment and takes the risk. According to most experts, this is not correct. There are constellations in the market in which companies invest but do not take over the operations. They source it out to other enterprises that take over the 'CPO' role. Therefore, a distinction between these two roles is important to understand the overall value network of this new domain. B14 puts it as follows:

'B14: Der Betreiber, ja der muss die/ den Betrieb sicherstellen. (…) Diskriminierungsfrei, dass der halt auch für den Kunden komfortabel ist. Und wer fehlt mir noch. Ja, derjenige der die installiert, ja also der Investor

oder sowas, der muss dafür sorgen, dass die Ladesäule an der richtigen Stelle ist, entsteht. Also der, der installiert, ist für mich, um das vielleicht noch mal zu schärfen, ist nicht derjenige gemeint, der das Loch gräbt und die Ladesäule anschließt, sondern derjenige der sagt, hier installiere ich eine Ladesäule, hier baue ich eine auf. Der muss ja nicht unbedingt derjenige sein, der sie anschließend auch betreibt. Können ja unterschiedliche Investitionsmodelle sein.'

Table 5 - Mentions of roles by experts, derived via QDA from the interviews

		Roles																
		End-Customer	CPO	Investor	EMP	EV Manufacturer	Roaming-Platform	Cross-Seller	Charging Station Manufacturer	Government	Location Provider	Energy Supplier	IT Operator Charge Point Management	Installer	Call Center	IT- Operator Roaming Platform	Municipality	No. of Roles mentioned by expert
Industry affiliation	Automotive	x	x	x	x	x	x	x	x		x				x			10
	Automotive	x	x	x	x	x	x	x			x		x					9
	Automotive	x	x	x	x	x	x	x	x	x	x	x						11
	Automotive	x	x	x		x	x	x		x		x						8
	Automotive	x	x	x		x		x	x	x		x						8
	Automotive	x	x	x	x	x	x	x			x							8
	Energy	x	x	x	x		x				x			x			x	8
	Energy	x	x	x	x	x	x	x	x				x					9
	Energy	x	x	x	x	x			x		x	x	x					9
	Energy	x	x	x	x	x	x	x	x		x	x						10
	Energy	x	x	x	x					x	x	x						7
	Manufacturing	x	x	x	x			x	x	x	x		x		x			10
	Manufacturing	x	x	x	x	x	x		x	x		x		x				10
	Manufacturing	x	x	x	x			x	x	x			x	x				9
	Services	x	x	x	x		x	x	x	x						x		9
	Services	x	x	x	x	x	x			x					x			8
	Services	x	x	x	x	x	x		x	x			x	x		x		11
	No. of mentions by experts	17	17	17	15	12	12	11	11	10	9	7	6	4	3	2	1	

All other expert have not mentioned the other roles. Nonetheless, there seems to be a broad consensus that there is a role offering access to fast charging infrastructure which I name, in accordance with most experts, 'Electric Mobility Provider'. There are four roles which are mentioned by approximately two-thirds of the experts: 'EV Manufacturer', 'Roaming Platform', 'Cross-Seller', and 'Charging Station Manufacturer'.

It is interesting to observe that not all experts with industry backgrounds from energy, manufacturing, and services see the 'EV Manufacturer' as an incremental part of the value network while all experts from OEMs do. A comparable situation holds true for the role 'Cross-Seller'. While all experts from the automotive industry mention it, not even half of the other experts talk about it. Besides the roles mentioned by the majority of experts, there are some roles which are mentioned only by few experts. However, these roles are valid due to the corresponding expert statements. Exemplary, expert B3 describes a personal experience made as part of her companies offer to consult investors in the installation of fast charging infrastructure:

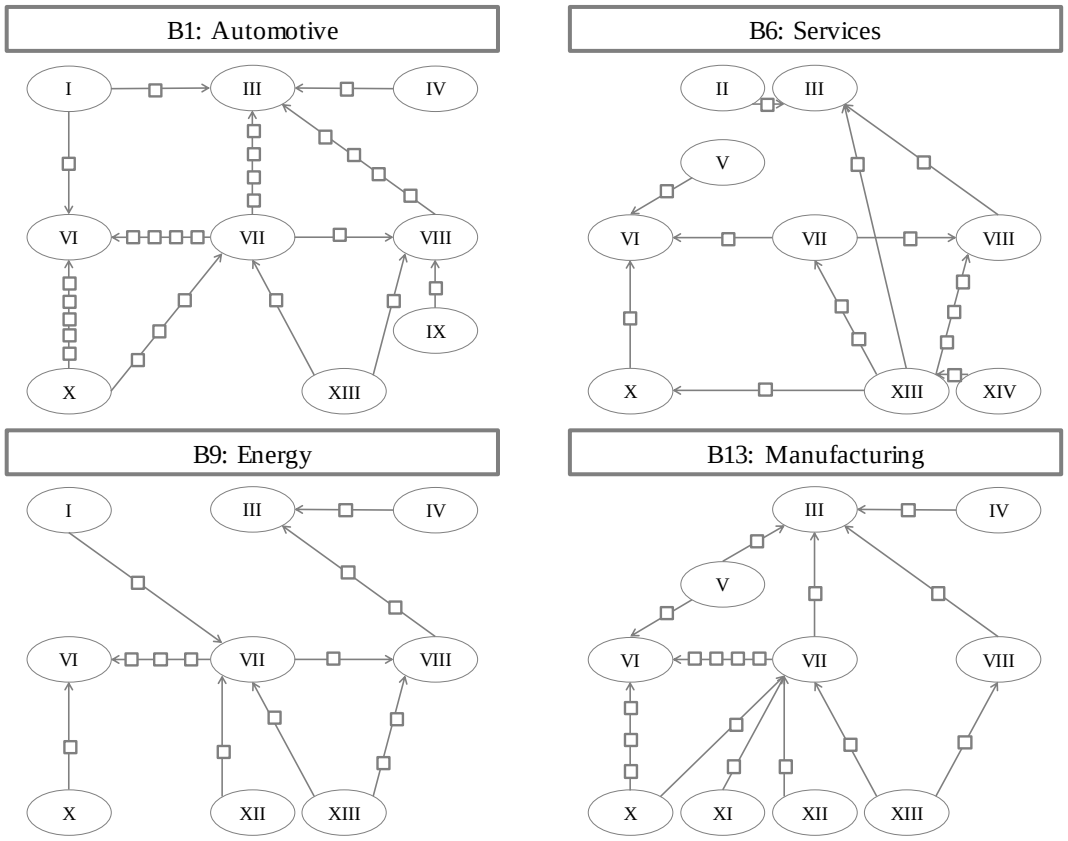
'B3: Gerade im öffentlichen Raum halt Stationen zu errichten, weil halt sehr viele unterschiedliche Fachabteilungen auf kommunaler Ebene eingebunden werden müssen. Sei es das Straßenverkehrsamt, sei es das öffentliche Recht und Ordnung und das Bauamt. Also alles unterschiedliche Instanzen, die/ mit denen wir sprechen müssen bevor wir eine Station überhaupt errichten können.'

This statement is deemed credible and describes a relevant situation in the process of installing fast charging infrastructure. Therefore, this role is included in the description of the value network of this new domain.

Structuring and logical deduction of statements allow, on a high level, for some initial analysis of the experts' perspectives on the value network in this new domain. Based on this set of roles, additional analysis is possible to deduct the relationships of these roles. Due to the complexity described by the experts, a visualization of the statements (see Figure 32) allows for an improved comparison between the experts' opinions on the value creation and delivery structure. Figure 33 displays pictograms of four visualizations of perspectives on the value network, representing all four industry backgrounds. The value network pictograms consist of roles (oval), value propositions (squares), and the direction of their offering (connectors). Identical roles are allocated at the same position within the network. Looking at the center of every pictogram, the 'CPO' role, which is mentioned by all experts, is placed there. In the right upper corner, the 'EV Manufacturer' role is positioned, which is only referred to by two of the four experts. Accordingly, this visualization emphasizes the different roles cited by the experts and the fact that the numbers and types of roles mentioned vary significantly among the experts.

Figure 33 also reveals that the experts not only have different views on the roles but the value propositions and the corresponding associations between roles as well. Looking at the left bottom corner of all four pictograms, these differences can be seen clearly. The role situated in this corner is 'Charging Station Manufacturer'. While all experts see an association between this role and the 'Investor' role (center left), two of them describe an additional association with the 'CPO' role (center). The differences between the experts increase when looking at the value propositions offered as part of these associations. Again, focusing on the association between the 'Charging Station Manufacturer' (bottom left) and the 'Investor'

role (center left) expert B6 and B9 describe one value proposition, B13 names three and out of the point of view of B1, there are five different value propositions in place. These are typical examples of how the experts have different perceptions of associations between roles on the most abstract level, already.



Legend:

I.	Location Provider	VI.	Investor	XI.	Installer
II.	Cross Seller	VII.	Charge Point Operator	XII.	Energy Supplier
III.	EV- User	VIII.	Electric Mobility Provider	XIII.	Roaming Platform
IV.	EV Manufacturer	IX.	Call Center	XIV.	IT-Operator Roaming Platform
V.	Government	X.	Charging Station Manufacturer		

Figure 33 - Pictograms of selected perspectives on the value network

Looking at these phenomena in more detail, the differences in views on the value network become even more evident (see Figure 34). Beginning with the different number of value propositions, expert B6 describes that there is only one value proposition offered by the 'CPO' role, 'Operations' of the infrastructure. B1, on the other hand, describes that the 'CPO' also provides the value propositions 'Installation', 'Maintenance', and 'Station Management'. Even if assuming that the broad term operations used by B6 might subsume the value propositions 'Technical Operations', 'Maintenance', and 'Station Management', it reveals that the level of abstraction used to talk about the subject varies considerably.

Additionally, B1 names the value proposition 'Installation', which is, according to B6 not part of the offering from 'CPO' to 'Investor'.

Example of different levels of abstraction in the descriptions of the value network (B1 (left) vs B6)

Example of different understandings concerning the value network (B9 (left) vs B13)

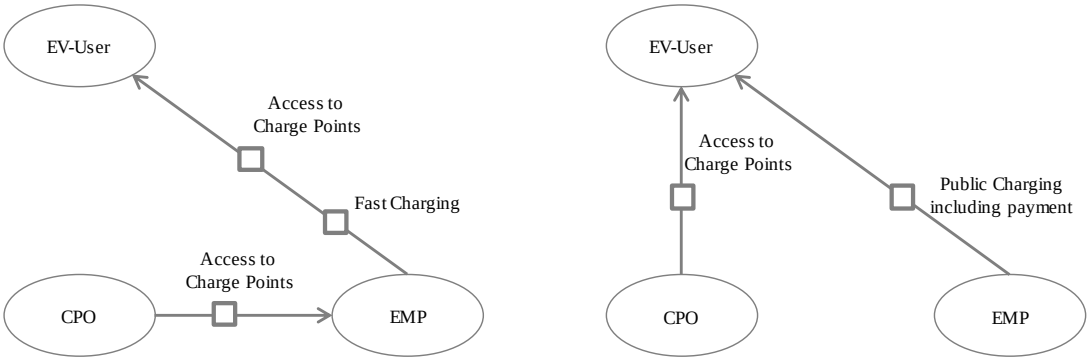


Figure 34 - Examples of different perceptions on the value network

The differences in perceptions of existing associations and therefore value propositions, in general, can be described by using the roles of 'CPO', 'EMP', and 'EV- User'. While expert B9 describes a value network in which the 'CPO' role offers 'Access to Chargepoints' to the 'EMP' who offers that to the 'EV- User' role, expert B13 has a very different understanding of the value creation. In her perception, the 'CPO' role provides 'Access to Charge Points' directly to the 'EV- User' role, and the 'EMP' role offers 'Public Charging including payment' to the 'EV- User' role. This example reveals a very different understanding of what role creates and delivers this value proposition to the 'EV- User'.

The phenomena revealed by the initial analysis based on QDA and the subsequent visualization of the experts' statements allow for some preliminary conclusion: even though the experts all work in this emerging domain and are asked approximately the same questions, the data reveals a highly heterogeneous understanding of how and by whom value is created and to what roles this value is delivered. In particular:

- The number of roles in the value network ranges from 7 to 11.
- A total of 16 different roles are mentioned by the experts.
- The number and nature of value propositions is highly heterogeneous.
- Value propositions are assigned to different roles.
- Associations and therefore value proposition offers between roles vary considerably.

- Wording and terms in use, even while describing the same topics, are highly heterogeneous.

3.6 Conclusion of the empiric explorative study in the area of fast charging infrastructure

Using qualitative research methods, 17 senior executives and top experts from companies representing the different industry sectors involved in the new domain are interviewed. They are asked about their perspectives on this new domain of fast charging infrastructure and their companies' business models. All experts except one have direct experience in electric mobility for two or more years. All of them show cross-company experience by participating in government funded research and demonstration projects and are part of the German National Electric Mobility Platform (Nationale Plattform Elektromobilität). The 17 interviews accumulate to a record of approximately 16 hours and lead to a transcript of about 115.000 words. This empiric data is coded following Mayring and Brunner's iterative qualitative analysis approach (Mayring & Brunner, 2009), building the empiric basis for the analysis concerning the financial viability of business models and the modeling of the individual perspectives on value creation in the domain.

The analysis of the financial viability reveals that due to the high initial investments and the limited number of customers, profitable business models do not exist for the companies that are active in this new domain. According to the experts, reasons for being part of this new area are mainly marketing as well as the conviction that this new domain is a key enabler for electric mobility in general. Even though this engagement could be considered a strategic investment by the companies, including the lack of need for profitability, most experts ask for governmental subsidies. Those subsidies should be mainly granted to the investors in infrastructure to create a sufficient offer of fast charging infrastructure. Nonetheless, the users of EVs should also receive some direct subsidies to stimulate the demand side of fast charging infrastructure, thereby supporting profitable business models. Besides governmental subsidies, some experts mention cross-selling and value-add services as opportunities to solve the issue that the business case of the standalone charging point is not positive. In this context, it is necessary to think about bundling of products and services. According to the experts, fast charging can make other, profitable products and services possible and therefore should be cross-subsidized by them. Collaborative business models could be implemented to facilitate this cross-subsidizing.

Unfortunately, as the second part of the analysis reveals, there is a lack of shared understanding amongst the experts concerning the value network (see Figure 35). Besides the fact that a common vocabulary does not exist amongst experts who have been working together for years, there are fundamental differences in the perception of value creation and delivery of value in this new domain. E.g., as shown in Chapter 3.5 (see Figure 33), the number and types of roles in the network vary significantly and also the corresponding associations and value propositions are highly disputed.

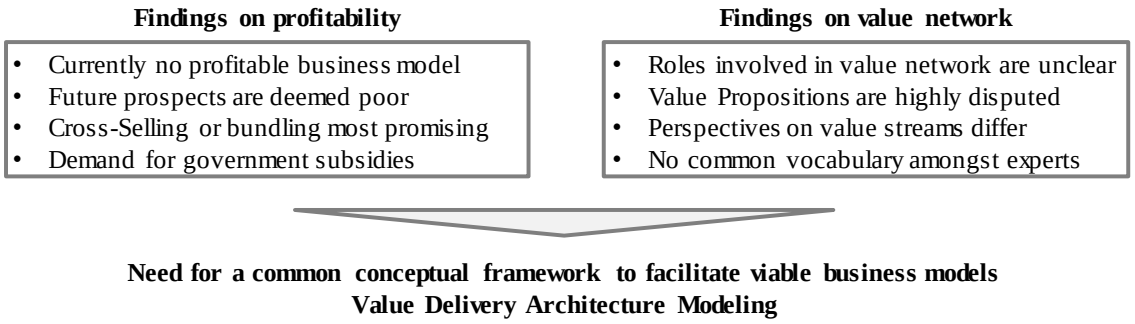


Figure 35 - Key findings of the empiric explorative study

To some degree, these diverse perspectives may be intrinsic to the research design based on semi-structured interviews (Barriball & While, 1994; Burnard, 1991; Diefenbach, 2009). Additional reasons may be the differences in industry and personal background of the experts. Besides these underlying aspects, four additional causes have been revealed:

- Experts use different levels of abstraction when talking about business model, roles, and value propositions.
- To describe the value network, experts use patterns associated with their company or other companies they know.
- An unambiguous, common cross-company vocabulary is missing in the domain.
- Among the experts exist significantly different convictions of how value is (supposed to be) created in the new domain of fast charging infrastructure installation and operations in Germany.

These results from the primary analysis show the need for a conceptual framework. As part of this framework, a common understanding of the value creation needs to be established. This can be provided by including domain ontology building (see Chapter 2.3) in the business modeling process. Thereby, the ontology needs to facilitate an improved communication amongst the stakeholders by offering a normative model which can be used for analysis as well as maintaining consistency within the system (Uschold & Gruninger, 1996). This consistency, including a common vocabulary and understanding of roles and value propositions, is fundamental for managing cross-company collaboration. Companies can only be able to work together efficiently on collaborative business models if there is a common understanding on what they are collaborating on.

Additionally, to enable a coherent analysis of the positioning of companies in this domain, further analysis and modeling are necessary to dissolve the remaining inconsistencies and impreciseness in the experts' statements. Additionally, a description of the roles is required to specify and document what the roles and value propositions encompass. I propose the application of VDAM framework to resolve these issues. This framework, including the corresponding views based on VDML and the application of semi-formal

ontologies, is deemed to provide the necessary consistency and transparency. In Chapter 4, VDAM will be discussed in detail and the corresponding instantiation of this approach in the domain of fast charging infrastructure will follow in Chapter 5. The latter includes the modeling of the overall value network of this new domain and the positioning of companies in this frame of reference.

4 Value Delivery Architecture Modeling

VDML and semi-formal ontologies are promising artifacts for reaching the goal of developing a new tool for business modeling that focusses on a common understanding of value creation and delivery including the positioning within a value network (see Chapter 2). These artifacts support the management of complexity and creation of a shared understanding amongst stakeholders. Thereby, VDML offers several visualization methods that allow to describe and manage complex value creation and delivery (see Chapter 2.2.4). Ontologies, on the other hand, enable common understanding and improved communication amongst stakeholders, therefore supporting collaborative efforts (see Chapter 2.3). The combination of these artifacts leads to the new business modeling tool Value Delivery Architecture Modeling.

The particular application of these artifacts in VDAM will be introduced in the following subchapters, beginning with a deduction of the motivation for this new tool (see Chapter 4.1). The introduction of the VDML elements in VDAM (see Chapter 4.2) and the VDAM ontology elements (see Chapter 4.3) follow next. Before displaying the VDAM framework (see Chapter 4.5), a subchapter is dedicated to explaining the opportunities of allocation of cost and revenue in VDAM (see Chapter 4.4). The chapter concludes with a summary, focusing on the contribution of VDAM to business modeling (see Chapter 4.6)

4.1 Motivation for the Value Delivery Architecture Modeling framework

As stated above, the electric mobility domain is a good example for how ventures are embedded in an increasingly complex and dynamic network of industry structures and apply collaborative value creation (see Chapters 1.1, 3.5, and 3.6). Amongst other things, this results into constellations of coopetion: the simultaneous existence of competitive and cooperative relationships between companies (Bengtsson & Kock, 2000). Hence, with respect to value creation, it becomes apparent that business modeling needs to provide tools and methods to analyze, evaluate und design the position of a company within its value creation network. In their meta-analysis of success factors for startups, Song et al. (2008) named the embeddedness in the supply chain to be of prominent importance for the success of a new venture. As displayed in Chapter 2.2.3, popular business model approaches focus on the focal company and the immediate, most important partners, while not addressing the overall value creation in a domain.

Besides addressing the value network, business models shall act as an intermediary between strategy and business process modeling (Al-Debei & Avison, 2010). Many of the popular business modeling languages, however, tend to focus on the strategic aspects of business models. This holds true even for languages

suggested by researchers agreeing with the intermediary role of business models (Osterwalder et al., 2005). These approaches are appropriate for business model development and innovation by taking strategic points of view and using only a few elements for its description (see Chapter 2.2.3). However, collaborative value creation or complex market environments including the mapping of the latter are not necessarily included or meant to be described with these approaches. Also, these languages, while proposing prototyping or testing of business model concepts, do not include tools to support the operationalization of business models (Al-Debei & Avison, 2010; Lindgren & Rasmussen, 2013; Osterwalder et al., 2005).

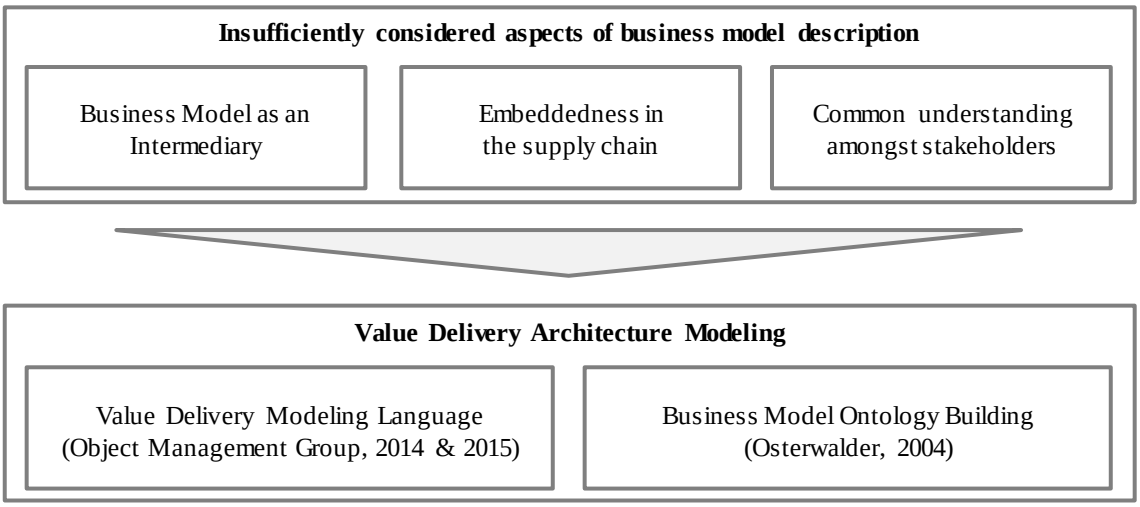


Figure 36 - Insufficiently considered aspects of business modeling need to be answered by VDAM

Additionally, a business model framework shall promote a common understanding amongst stakeholders as well as foster dialogue (Al-Debei & Avison, 2010; Zott & Amit, 2010). The study in the area of fast charging infrastructure confirmed an educated assumption much discussed in the course of this research project: often a common understanding amongst parties involved is hard to achieve (see Chapter 3.5). As the study shows, partners in collaboration have a very different understanding of value creation and delivery. This is of interest because most of these experts have been working together in the field of fast charging infrastructure for several years including the discussion of business model ideas for its viable operation (see Chapter 3.2). Additionally, the study reveals that there is not even a common vocabulary in this new domain, even though the experts have been collaborating in projects and working groups for several years (see Chapter 3.5). While most approaches offer tools to visualize ideas, to the authors' knowledge the popular business modeling tools fall short on creating a shared understanding due to the lack of written descriptions (see Chapter 2.2.3).

Combining the underlying understanding of what a business model should achieve, the status quo of available business modeling approaches, and the results of the study in the new field, several goals for VDAM can be deduced. VDAM as a tool should:

- Allow to analyze, evaluate und design the embeddedness in the supply network.
- Create a common understanding amongst stakeholders.
- Support the operationalization of business model ideas.

To reach these three goals, the tool VDAM is based on two existing artifacts, Value Delivery Modeling Language (Object Management Group, 2014, 2015) and Ontologies in Business Modeling (Osterwalder, 2004). These artifacts are combined to describe and depict value creation networks (Pathak et al., 2007) and the embeddedness in the supply chain (Song et al., 2008) of an innovative business model, be it a start-up or innovation within an established company. Additionally, the creation of a shared understanding amongst stakeholders (Zott & Amit, 2010) is reached by the combination of visualizations and the precise description in an ontology. By offering different modeling views and the opportunity to particularize aspects, the support of subsequent operationalization, and thereby the role as an intermediary between strategy and business process modeling (Al-Debei & Avison, 2010) is being addressed. Thereby, the term architecture is an analogy to its use in Information Systems modeling and refers to the conceptual and functional partition of the value creation processes. The particular application and combination of these existing artifacts within VDAM are described in the subsequent chapters.

4.2 VDML Elements in VDAM

VDML is a UML-specified modeling language that offers several views and diagrams to model and to visualize value creation and delivery (see Chapter 2.2.4). In VDAM, a subset of these elements is being used to visualize business model ideas, namely Value Proposition Exchange Diagram, Network Activity Diagram, Capability Management Diagram, and Measurement Dependency Graph. In the following, these diagrams and views will be introduced, including specific restrictions and requirements for their application in VDAM. The definition of rules of application for these diagrams is necessary due to the powerfulness and extensiveness of VDML as specified by the Object Management Group (2014, 2015).

Value Proposition Exchange Diagram

The key diagram used in VDAM is the so-called Value Proposition Exchange Diagram from VDML. This kind of diagram consists of three types of elements: roles (R), value propositions (VP), and connectors (C) (see Figure 37). Here, roles are defined as abstract elements describing patterns of behavior or capabilities. Value propositions represent tangible and intangible values of deliverables. Connectors represent the association that connects a role with a value proposition or a value proposition with a role (Object Management Group, 2014, 2015). For the application within VDAM, a VPED can be described as a 3-tuple (R, VP, C), where

- R is a finite set of roles.
- VP is a finite set of value propositions.
- R and VP are disjoint.
- C: (R x VP) ∪ (VP x R) ∈ ℕ is a multi-set of arcs.

As a result, a distinct value proposition can only be offered from one role to one other role. Additionally, a particular role can only offer one value proposition towards one other role. Furthermore, since roles and value propositions must not be identical within VDAM, they cannot have the same names. These additional restrictions on the design of this important view aim to ensure comparability of roles and value propositions due to a consistent level of abstraction. Additionally, a clear distinction between roles and value propositions is guaranteed. Following this approach, the resulting Value Proposition Exchange Diagram in VDAM visualizes and describes the value delivery from a more strategic perspective.

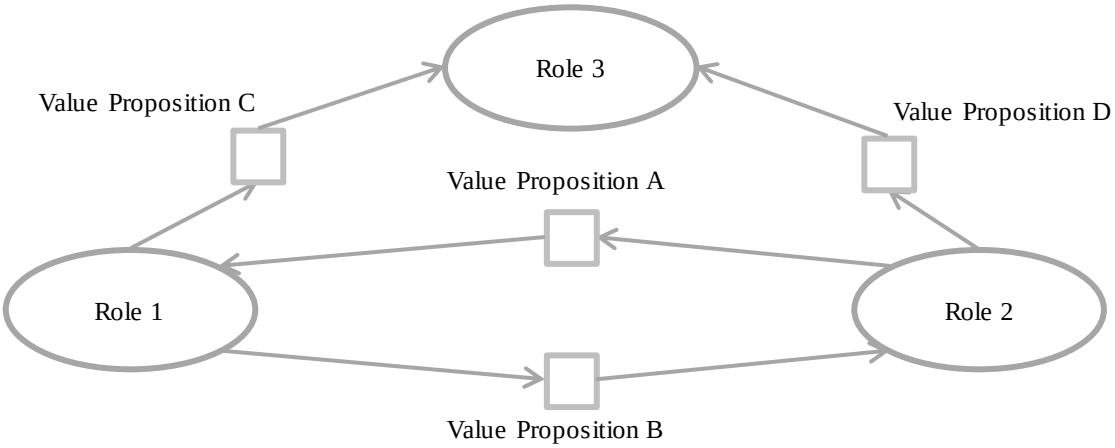


Figure 37 - Elements of a Value Proposition Exchange Diagram in VDAM

This visualization of value creation and exchange on a more strategic level enables the model designer and users of this model type to create a common understanding of the value network. Additionally, several types of analysis such as competitiveness of roles or the positioning of companies in the value network can be conducted. Besides as-is analysis, potential changes to the value creation network and its effects on the overall value creation and exchange can be analyzed. Therefore, it represents a sound basis for analysis, evaluation, design and common opinion building. It helps to identify the role and value proposition of a venture and thereby positions it strategically within the value creation network. Applications of this diagram are discussed in more detail in Chapter 5.2 when describing the instantiation of VDAM in the domain of fast charging infrastructure in Germany.

Additionally, three types of diagrams can be derived from this overall Value Proposition Exchange Diagram. They can be used to generate a more informed decision based on additional transparency and

understanding of critical processes (Activity Network Diagram), necessary capabilities and their allocation (Capability Management Diagram) as well as influencing relationships between measured characteristics (Measurement Dependency Graph). Subsequently, the elements of these diagrams are presented. Again, as part of the instantiation of VDAM in the domain of fast charging infrastructure in Germany, applications of these diagrams are explained in detail Chapter 5.3.3.

Network Activity Diagram

The Network Activity Diagram within VDML is a concrete manifestation of a swim-lane diagram and is used to display the necessary activities and the corresponding deliverable flow to convey a value proposition. Thereby, roles required for a particular process are represented as swim lanes. Activities performed by a role are shown as rectangles with rounded corners and are allocated in the swim lane of the corresponding role. Activities produce or consume business items. A business item within VDML is anything that can be created (e.g. products), bought (e.g. parts) or that conveys information (e.g. emails). The transport of a business item, the deliverable flow, is visualized by a connector and the name of the deliverable is put alongside the connector. Deliverables can be transported between activities but also to or from stores and pools. Stores, visualized by triangles, hold resources which represent the stored business item. In case a business item is re-usable, the store is a pool, a specialized store, represented by the re-use shape.

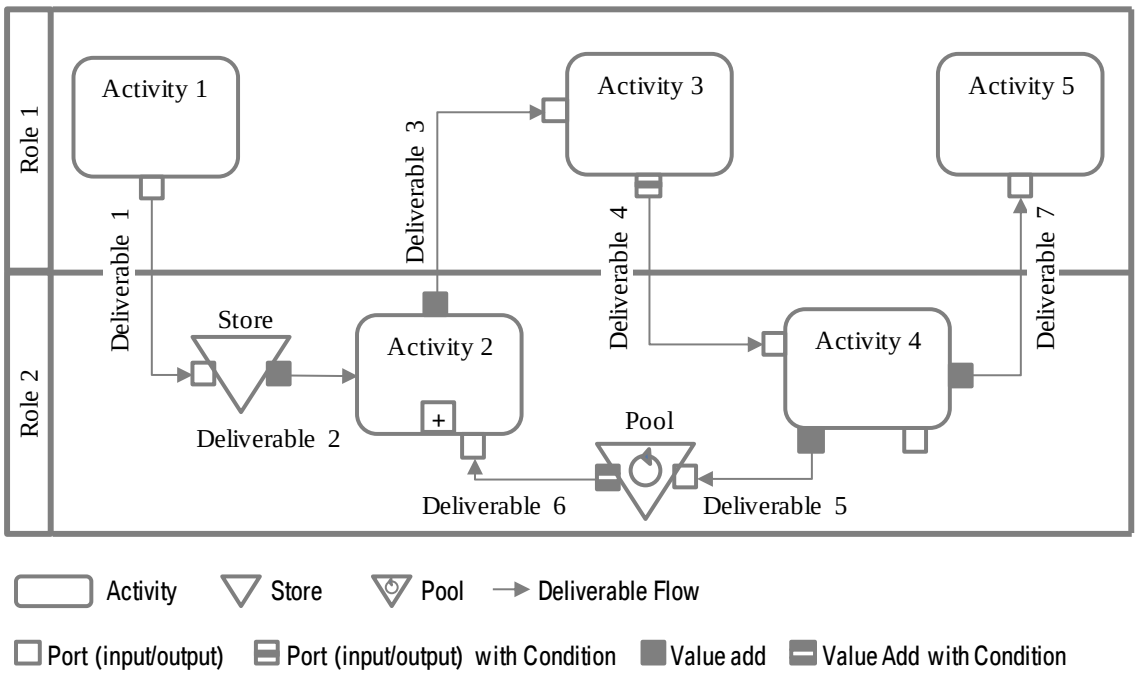


Figure 38 - Example of an Activity Network Diagram in VDAM

Deliverable flows start and end in so-called ports. Small rectangles represent these ports. Within VDAM four different types of ports are used. A small open rectangle represents a port in its most general sense,

e.g. see port at Activity 1 in Figure 38. Adding a splitter to this rectangle shows that a condition needs to be met to hand over or receive a deliverable, e.g. see port with a condition at Activity 3 in Figure 38. A filled rectangle represents that the activity and the corresponding deliverable conveys a value add to the overall value proposition, e.g. see value add at Activity 2 in Figure 38. Adding a splitter to this port shows that some condition needs to be met to hand over the value add, e.g. value add with a condition at the pool in Figure 38. Finally, VDAM makes use of the expand button, e.g. Activity 2 in Figure 38, a small rectangle with a '+' inside to indicate, that an activity might be subdivided and described in more detail. This is an example of the expandability of VDAM graphs, which can be applied if a more detailed view is deemed to be of value to enable a more informed decision on if and how to implement a business model idea.

Network Activity Diagrams enable the design of the main processes which are necessary to offer specific value propositions. The visualization can be used to identify critical steps in the value creation process and clarify responsibilities of partners and organizational units. Another application opportunity is the determination of overall process improvements. In case that none value-adding activities can be identified as part of the modeling and analysis, the question should be raised if a leaner process might be implemented. In conclusion, the explicit description of the main processes furthers the latter operationalization in business process models.

Capability Management Diagram

Capability Management Diagrams in VDAM are used to model the necessary capabilities to deliver value propositions. Within such a chart, organizational units are the defining elements of the structure of the diagram. An organizational unit is represented by a rectangle with a name label on top of it. Organizational units have capability offers, shown as stretched hexagons with the corresponding names inside. A capability offer represents the offering of an organizational unit. It is dependent on a capability method represented by a rectangle (e.g. Capability Offer 1 in Figure 39) or a store represented by a triangle (e.g. Capability Offer 3 in Figure 39). The capability method defines what activities, resources, business items and other requirements are needed to deliver a capability including the corresponding value contribution. Capability methods can also depend on or are being supported by other capability offers of other organizational units (e.g. Capability Method 2 in Figure 39). If such a relationship exists, the capability offer is located on the boundary of the organizational unit, and a small dotted line connects the method with the offer of another organizational unit.

Within VDAM, an organizational unit represents a role in the value network. Depending on the needs of the model designer or decision maker, also more detailed levels, e.g. business units or departments can be modeled with this view. Within VDAM, I refrain from the use of so-called 'position roles', which allow modeling of necessary roles which can be allocated to particular participants. VDML 'position roles' might be of interest when modeling detailed perspectives to prepare an implementation phase, but are of limited

value to the model designer at an early stage of preparing an informed decision on if and how to implement a BMI.

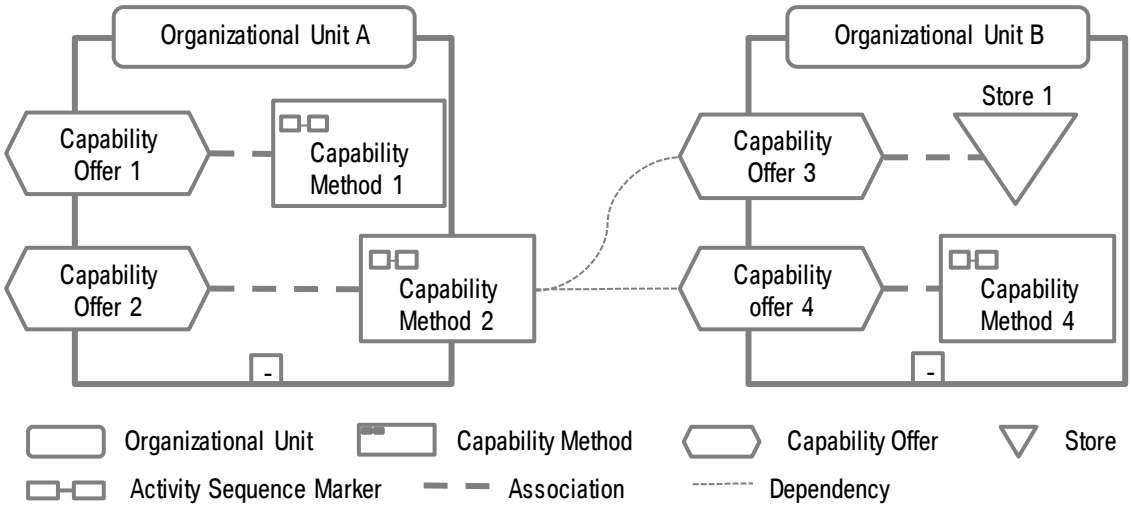


Figure 39 - Example of a Capability Management Diagram in VDAM

Capability Management diagrams can be used to identify the necessary capabilities and resources for the delivery of a value proposition. Additionally, a gap analysis between existing and needed capabilities can be established, and decisions towards partnerships or internal knowledge, resources, or capability buildup can be made. By displaying organizational units and the allocated capabilities, this type of diagram can also be used as input for the design of an organization to implement a specific business model, thereby facilitating a latter operationalization of a business model idea.

Measurement Dependency Graphs

Measurement Dependency Graphs within VDAM display relationships between different measured elements and their influence on each other (see Figure 40). Examples of measured elements are Activities, Collaborations, Stores, or Value Propositions, depending on the focus of analysis. Common to all measured elements is that they have a measured characteristic, represented by a rectangle shape. 'Measured' as a term is a bit misleading, because, besides real measurements, observations and also estimates can be the basis for a measured characteristic. Due to the usage of this term within VDML, I suggest the usage of this word within VDAM as well. Just as a measured element can represent different business elements, the measured characteristic within a diagram can represent various types of values depending on the focus of the analysis, e.g. cost associated with activities, product prices, the performance of a deliverable, or repair duration. The name of the characteristic is written in this shape. Relationships between two measured characteristics are displayed with a connector. If the increase of a measured characteristic has a positive influence on a related measured characteristic (e.g. the relationship between measured characteristic 1

and 3) a heptagon with a '+' is added as a marker to the connector. In the case of negative influence, a heptagon shaped marker with a '-' is added to the connector. In VDAM, just as in VDML, circular relationships (e.g. relationship circle of measured characteristic 1, 3, 4, and 2) are allowed.

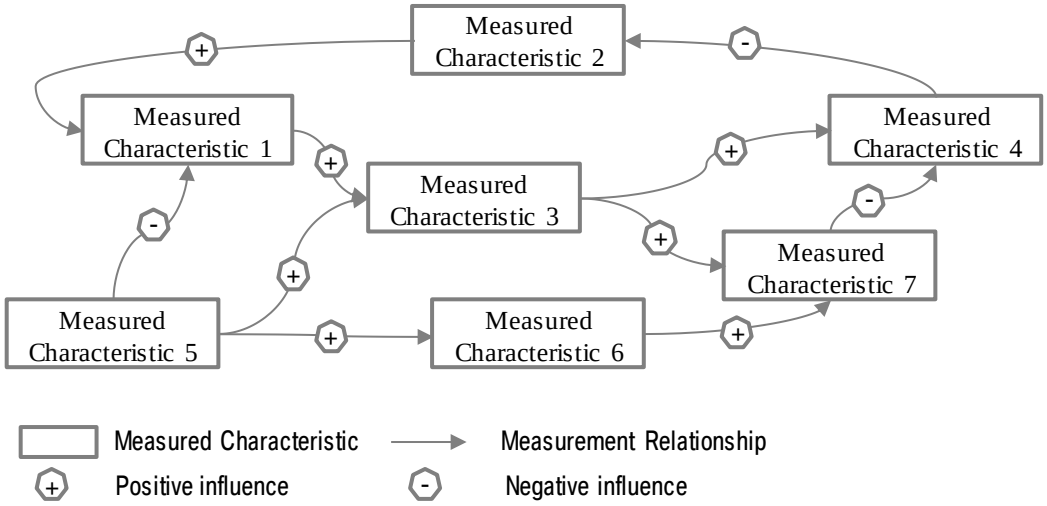


Figure 40 - Example of a Measurement Dependency Graph in VDAM

A Measurement Dependency Graph within VDAM is a very flexible tool to shed light on implicit relationships between different elements. E.g. a Measurement Dependency Graph can display the logic of value creation and value contribution. Therefore, it facilitates an informed decision about critical steps. Within VDAM, the primary usage is the visualization of cost and value creation.

These views on key aspects of value creation and delivery between roles in a domain are essential enablers for the analysis, evaluation, and design of business models, as they create a visual representation that enables stakeholders to create a common understanding of the situation. This also facilitates to articulate and evaluate options and thereby leads to a more informed decision on BMI. Nonetheless, visual representation still allows for a certain level of interpretation and therefore divergence in understanding. A textual description is of key importance to facilitate a better common understanding amongst stakeholders in the business modeling process. This is introduced in the subsequent chapter.

4.3 Ontology building in VDAM

As stated above (see Chapter 2.3.1 and 2.3.3) main categories for the use of ontologies are communication, interoperability and systems engineering. With respect to the application of VDAM, the communications aspect is of key importance for this work. Thereby, ontologies can be used as a normative model of a system to create semantics for the system and allow for extensibility and refinement. Additionally, using ontologies as a network of the main associations enables the tracking of links between entities and the alignment

assumptions. Of particular significance is the provisioning of unambiguous definitions for terms to allow consistency and reduce ambiguity. Accordingly, ontologies allow integrating different stakeholder perspectives by explicitly describing what an organization does, what goals it achieves and how they are achieved (Uschold & Gruninger, 1996). Even though the use of an informal but still unambiguous ontology is sufficient for increased communication between people (Uschold, 1996), VDAM incorporates a semi-informal or semi-structured ontology (Uschold & Gruninger, 1996), based on Osterwalder's Business Model Ontology approach (Osterwalder, 2004). I choose this more formal category of an ontology because compared to highly informal ontologies, the level of clarity and the corresponding reduction of ambiguity is much higher (Uschold & Gruninger, 1996). Based on the results of the study in the area of fast charging infrastructure in Germany (see Chapter 3.5 and 3.6) this increased effort is deemed necessary and valuable to the users of VDAM.

The graphical representations of VDML facilitate the understanding of associations between roles and their corresponding value propositions. The development of a domain ontology complements the approach and establishes a common language and understanding. The information captured in the ontology is directly related to the requirements of the VDML elements described above. Therefore, in addition to the elements role and value proposition which are part of the Value Proposition Exchange Diagram, the elements capability and activity are included in the ontology. These four types of elements are necessary for the design of the more detailed views. For the description of the ontology elements, Osterwalder's Business Model Ontology approach is being applied which consists of seven categories: Name of the Element, Definition, Part of, Related to, Set of, Cardinality, and Attributes (Osterwalder, 2004).

Name and Definition are being used to describe the elements and create a common understanding specifically. The categories Part of, Related to, and Set of are being used to describe the semantic relationship of elements. Even though I abstain from this additional level of detail due to the increased complexity, elements can be decomposed into subelements to allow for different levels of granularity in the analysis. For instance, an element Value Proposition can be decomposed into several Value Proposition Components. The category Cardinality defines the number of possible appearances of elements in the approach. By definition, the cardinality of the entities of role and value proposition is one. The entities of other elements which are used in the more detailed diagrams can have other cardinalities. This enables reuse of these elements during the design process when deemed helpful. Finally, the category 'Attributes' defines what attributes should be used to describe entities of an ontology element. Thereby, consistency to VDML is achieved by considering the VDML class definition when appropriate (Object Management Group, 2014, 2015). Subsequently, the four VDAM elements role, value proposition, activity, and capability are being described in detail.

A role within VDAM is defined as an expected pattern of behavior or capability profile (see Table 6). This definition underlines the understanding within VDAM that a role shall not be confused with a company (see Chapter 4.2). Roles offer and receive value propositions and can be occupied by one or several actors. Therefore, to describe a role entity, a distinct name needs to be chosen. A description and an example shall create unambiguous understanding about the role amongst stakeholders. Actors need to be mentioned as well. If a role receives a value proposition within the VPED, the Boolean of the target role is true. Every received value proposition needs to be named. If a role is offering a value proposition to another role, the Boolean for offering role is true, and the offered value proposition is stated. A role can be offering role and target role but is at least one of the two. A role with target role 'false' and offering role 'false' would not be part of the value network.

Table 6 - VDAM domain ontology element: Role

Name of Element	**ROLE**
Definition	ROLE describes an expected pattern of behavior or capability profile. A ROLE receives and/or offers VALUE PROPOSITION(S). A ROLE can be occupied by one or several actors.
Is Part Of	VDAM_Elements
In Relation to	VALUE PROPOSITION CAPABILITIES ACTIVITIES
Consists of	-
Cardinality	1-n
Attributes	Name {abc} Description {abc} Example {abc} Actor {abc} Target Role {Boolean true/false} Received Value Proposition {Value Proposition} (0-n) Offering Role {Boolean true/false} Offered Value Proposition {Value Proposition} (0-n)

Value proposition represents a tangible or intangible value offered from one role towards another role (see Table 7). Therefore, after choosing a distinct name, describing it, and giving an example, value proposition entities need to display what their corresponding target role and offering role are. Every value proposition has not more than exactly one target role and one offering role. Besides this definition of relationships within the VPED, the attributes value for target role and value for offering role need to be defined. Value for a target role is related to the price that a target role is willing to pay for the value proposition. Value for offering role represents the price that the offering role is expected to achieve (see further Chapter 4.4). To create, offer, and deliver a value proposition, activities and the corresponding capabilities are necessary. Therefore, the necessary activities and capabilities shall be listed as attributes. These attributes can be

considered optional, because not every process concerning the manifestation of a value proposition needs to be described within VDAM. Hence, not every value proposition is necessarily linked to activities and capabilities outlined in the ontology.

Table 7 - VDAM domain ontology element: Value Proposition

Name of Element	**VALUE PROPOSITION**
Definition	VALUE PROPOSITION represents tangible or intangible value offered by a ROLE towards another ROLE
Part Of	VDAM_Elements
Related To	ROLES CAPABILITIES ACTIVITIES
Set Of	-
Cardinality	1 - n
Attributes	Name {abc} Description {abc} Example {abc} Target Role {Role} Value for Target Role {value} Offering Role {Role} Value for Offering Role {value} Activities {Activities} (0-n) Capabilities {Capabilites} (0-n)

Table 8 - VDAM domain ontology element: Activity

Name of Element	**ACTIVITY**
Definition	ACTIVITIES define work to be done by actors in ROLES to offer a VALUE PROPOSITION. The same ROLE may perform multiple ACTIVITIES. The ACTIVITY identifies the type of CAPABILITY required to perform the ACTIVITY.
Is Part Of	VDAM_Elements
In Relation to	ROLE CAPABILITY VALUE PROPOSITION
Consists of	-
Cardinality	1-n
Attributes	Name {abc} Description {abc} Example {abc} Required Capability {Capability} (1-n) Enabled Value Proposition {Value Proposition} (1-n) Value of Activity {Value} (1-n) Cost of Activity {Value} (1-n)

Activities within VDAM are used to create, offer, and deliver a value proposition. If the model designer chooses to use Network Activity Diagrams to visualize key processes, these activities should be documented in an entity of the domain ontology (see Table 8). Besides name, description, and example, the required capabilities to perform an activity should be described. Additionally, the attribute 'enabled value proposition' needs to be filled in. Thereby, an activity creates a business item (see Chapter 2.2.4) that provides value to the value proposition. This value shall be stated in the ontology, ideally as value per activity performed. While creating business items, activities also consume resources (see Chapter 2.2.4). The corresponding costs need to be documented in the ontology as well.

The fourth ontology element type is capability (see Table 9). A capability is defined as the ability to execute a repeatable pattern of actions, required to offer a value proposition. Besides the name, description, and example, the particular ontology entity of a capability needs to contain which activities and value propositions are being enabled with this capability. One capability can enable more than one activity and value propositions. Comparable to activities, capabilities create direct value for a value proposition as well. This is met by the attribute value of capability. The corresponding costs are documented in the attribute cost of capability. While activities create value and costs by performing them, the costs for capabilities occur independently. Nonetheless, because capabilities might contribute to several value propositions an allocation of the cost towards specific value propositions is possible.

Table 9 - VDAM domain ontology element: Capability

Name of Element	**CAPABILITY**
Definition	A CAPABILITY is the ability to execute a repeatable pattern of actions (ACTIVITIES) that is necessary in order to offer value to a ROLE (VALUE PROPOSITION).
Is Part Of	VDAM_Elements
In Relation to	ROLE VALUE PROPOSITION ACTIVITY
Consists of	-
Cardinality	1-n
Attributes	Name {abc} Description {abc} Example {abc} Enabled Value Proposition {Value Proposition} (1-n) Value of Capability {Value} (1-n) Cost of Capability {Value} (1-n) Enabled Activities {Activities} (1-n)

Therefore, the use of Osterwalder's (2004) Business Model Ontology approach explicitly describes and defines the key elements of the graphical representation in VDML-based VDAM diagrams. Every entity of

the VDAM elements role, value proposition, activity, and capability that is visually displayed in one of the diagrams needs to be described in the domain ontology. Thereby, the use of this semi-formal domain ontology in VDAM enables stakeholders to establish a common language and understanding, thus reducing ambiguity through explicit definition and description.

4.4 Profitability assessment in VDAM

In the course of developing VDAM based on elements of VDML (Object Management Group, 2014, 2015) and Business Model Ontologies (Osterwalder, 2004), it becomes apparent that the topic of profitability assessment needs to be addressed in more detail. Even though the focus of VDAM is to offer opportunities to model embeddedness in the supply network, create a common understanding and support operationalization (see Chapter 4.1), the financial viability of BMI is of fundamental importance as well.

Within the set of applied VDML elements the Measurement Dependency Graph (see Chapter 4.2) can be used to visualize costs and earnings. In combination with the business model ontology, this allows determining the financial viability of value propositions and business model ideas. Even though there is no assisting software for applying VDAM, the underlying concepts and the potential of determining financial viability within VDAM needs to be displayed. As presented in Table 7 (see Chapter 4.3) the domain ontology entails two different types of value: value for target role and value for offering role. This distinction is made because it is important to acknowledge that there are two perspectives on a value proposition, the one from the receiving role and the one from the offering role (see Figure 41).

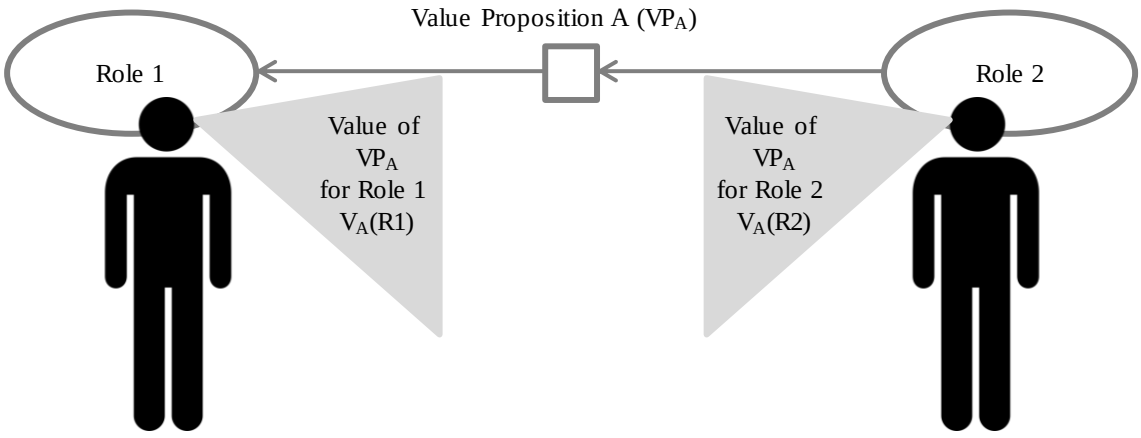


Figure 41 - Perspectives of roles on a value proposition within VDAM

As displayed in Equation 1, a financially viable value proposition exists if the value for a receiving (or target) role (role 1 in Figure 41) is at least as high as the value for the offering role (role 2 in Figure 41).

Equation 1 - Viability of value propositions

Viable value proposition: $V_A(R1) \geq V_A(R2) = TM(R2) * [VA_A(R2) + V_B(R2)]$
Not viable value proposition: $V_A(R1) < V_A(R2) = TM(R2) * [VA_A(R2) + V_B(R2)]$

$V_A(R1)$: Value of offered Value Proposition A for Role 1 = willingness to pay
$V_A(R2)$: Value of offered Value Proposition A for Role 2 = expected revenue
$TM_A(R2)$: Target Margin of Role 2 for Value Proposition A
$VA_A(R2)$: Value Add by Role for Value Proposition A
$V_B(R2)$: Value of received Value Proposition B for Role 2 = cost of Value Proposition B

Thereby, the value for the receiving target role is related to the price that the target role is willing to pay for a value proposition. On the other hand, as displayed in Figure 42, the value for the offering role represents the cost of delivering the value and the margin that the offering role aims to achieve. Thereby, the cost of providing a value proposition can be divided into two aspects: the cost of creating a value-add and the cost of acquiring other value propositions which are needed to offer a value proposition. Therefore, $V_B(R2)$ implicitly includes the target margin and cost of delivering the value proposition B by Role 3.

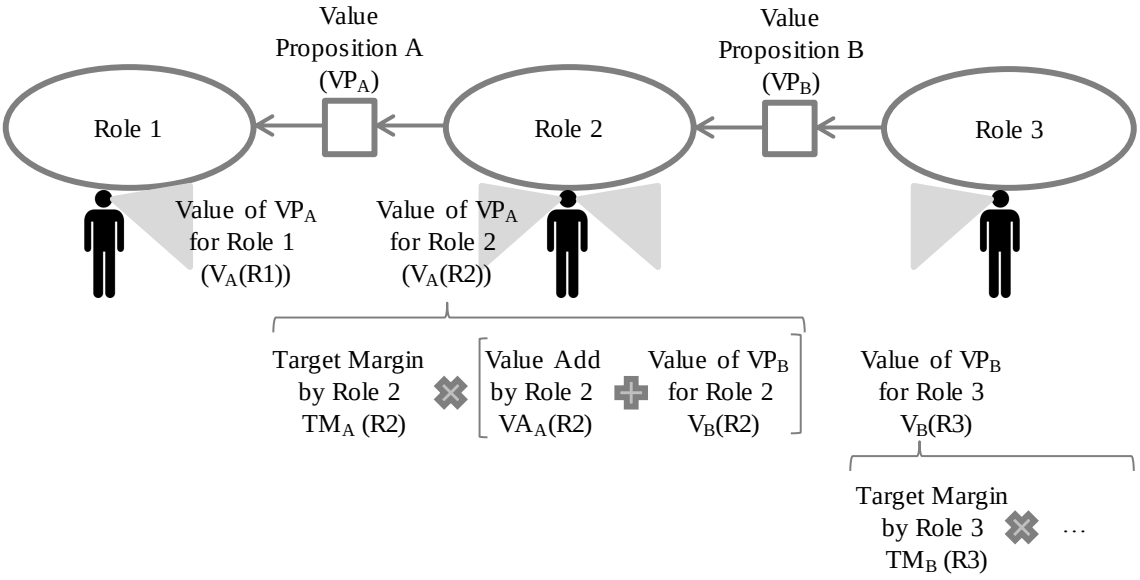


Figure 42 - The logic of value accumulation along the value network

Value Add has a special importance in this equation because it represents the performed activities and the capabilities of a company to create value. It is important to acknowledge that, in accordance with VDML (see Chapter 2.2.4 or (Object Management Group, 2014, 2015)), the availability of capabilities is a necessary precondition to performing activities. Therefore, both types of VDAM elements take part in the value adding process. While capabilities and activities create value, they both cause cost as well. Capabilities cause cost, independent of the fact if they are used or not. Activities, on the other hand, only

cause cost if they are performed. Ideally, the Value Add is at least as high as the accumulated cost of all cost for capabilities and the activities performed (see Figure 43).

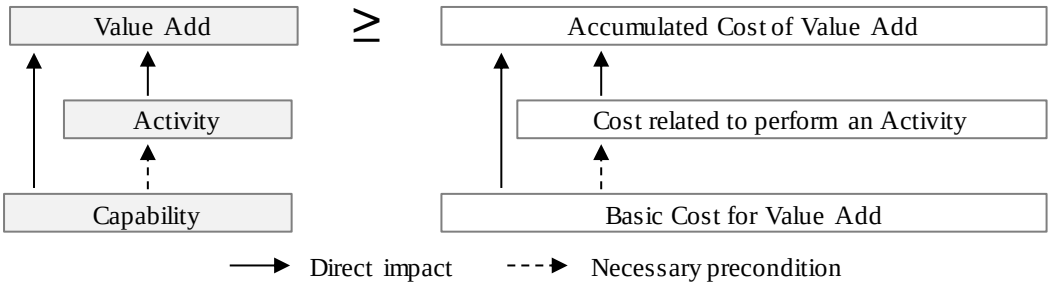


Figure 43 - Composition of the Value Add and the corresponding cost logic

Therefore, Value add can be mathematically described by the following Equation 2:

Equation 2 - Value Add as a sum of its corresponding cost

Value Add: $VA \geq CVA = \sum_{a=1}^{n} CC_a + Xa * CAa$

CVA: Accumulated cost of Value Add
CC: Basic cost of a Capability to create a Value Add
CA: Cost of performance of an Activity to create a Value Add
X: Number of performances of Activity to create Value Add
a: Capabilities and Activities needed to create a Value Add

Therefore, the viability of a value proposition can be described by the following Equation 3:

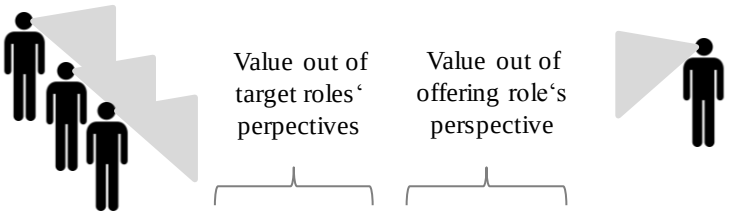
Equation 3 - Viability of a value proposition

$$V_A(R1) \geq V_A(R2) = TM_A(R2) * [\sum_{a=1}^{n} (CC_a + Xa * CAa) + V_B(R2)]$$

$V_A(R1)$: Value of offered Value Proposition A for Role 1 = willingness to pay
$V_A(R2)$: Value of offered Value Proposition A for Role 2 = expected revenue
$TM_A(R2)$: Target Margin of Role 2 for Value Proposition A
$VA_A(R2)$: Value Add by Role 2 for Value Proposition A
$V_B(R2)$: Value of received Value Proposition B for Role 2 = cost of Value Proposition B
CC: Basic cost of a Capability which is needed to perform Activities to create a Value Add, irrespective of the actual performance
CA: Cost of performance of an Activity to create a Value Add; This has to be multiplied with the number of performances needed (X)
a : Capabilities and Activities needed to create a Value Add

The value of a value proposition for the receiving target role needs to be at least as high as the cost of value add and the value of the received value propositions, both multiplied with the target margin for this value proposition.

The viability of a value proposition is an important concept when looking at the viability of business models for a role. VDAM allows for a role to offer value propositions to more than one role and can also receive value propositions of several roles. Therefore, generalizing the logic of a single value proposition of a role to the business model of a role leads to the following equation displayed in Figure 44:



Viable Business Model for Role Z : $\sum_{a=1}^{n} V_{a\,(}Ra) \geq \sum_{a=1}^{n} V_{a\,(}RO)$

Not Viable Business Model for Role Z: $\sum_{a=1}^{n} V_{a\,(}Ra) < \sum_{a=1}^{n} V_{a\,(}RO)$

With

a:	specific Value Proposition (VDAM: one VP can only be offered to one role)
V_a:	Value of a Value Proposition
R_a:	Target role for Value Proposition a
RO:	Offering Role
$V_a(R_a)$	Value of a Value Proposition out of target role's perspective = price willing to pay
$V_a(RO)$	Value of a Value Proposition out of offering role's perspective = cost + margin

Figure 44 - Viability of business models in VDAM

The fact that a role can offer different value propositions to different target roles, makes it possible that the business model of a Role is viable, while not every value proposition itself is viable to the offering role.

The subchapter describes the potential of the combination of VDML views and the specified application of business ontologies. If deemed appropriate, the business model designer and stakeholders are enabled to conduct detailed analyses of cost and revenue of roles, value propositions, and ultimately business model ideas. In VDAM every value proposition within the frame of reference incorporates two views on its value: the perspective of the target role and the point of view of the offering role. The view of the offering role consists of the corresponding cost of value offering, multiplied with a target margin. These costs can be determined on the detailed level of activities and capabilities if this information is available. If this information is only available to a certain degree, it is feasible to complement it with assumptions or expert estimates to allow for a profound as possible analysis on profitability. If this effort is not suitable or possible for the model designer and the stakeholders, assumptions or estimates on the value proposition level can suffice.

4.5 The Value Delivery Architecture Modeling framework

The previous subchapters focused on the motivation for a new tool (Chapter 4.1), the used VDML diagrams and their application (Chapter 4.2), and the utilization of Osterwalder's (2004) Business Model Ontology (Chapter 4.3) as part of VDAM. Additionally, the allocation of cost and revenue within VDAM was introduced (Chapter 4.4). These inputs are joined into the VDAM framework, which will be presented subsequently.

As described above, the VDAM tool makes use of VDML diagrams and the business model ontology to create a frame of reference for a given domain. In Figure 45, the systematic approach with typical steps and iterations is displayed. This process can be a considerable effort. I argue that this effort is time well spent, as it creates a foundation for key managerial decisions, as shown in Chapters 5.2.4, 5.3.2, and 5.4.

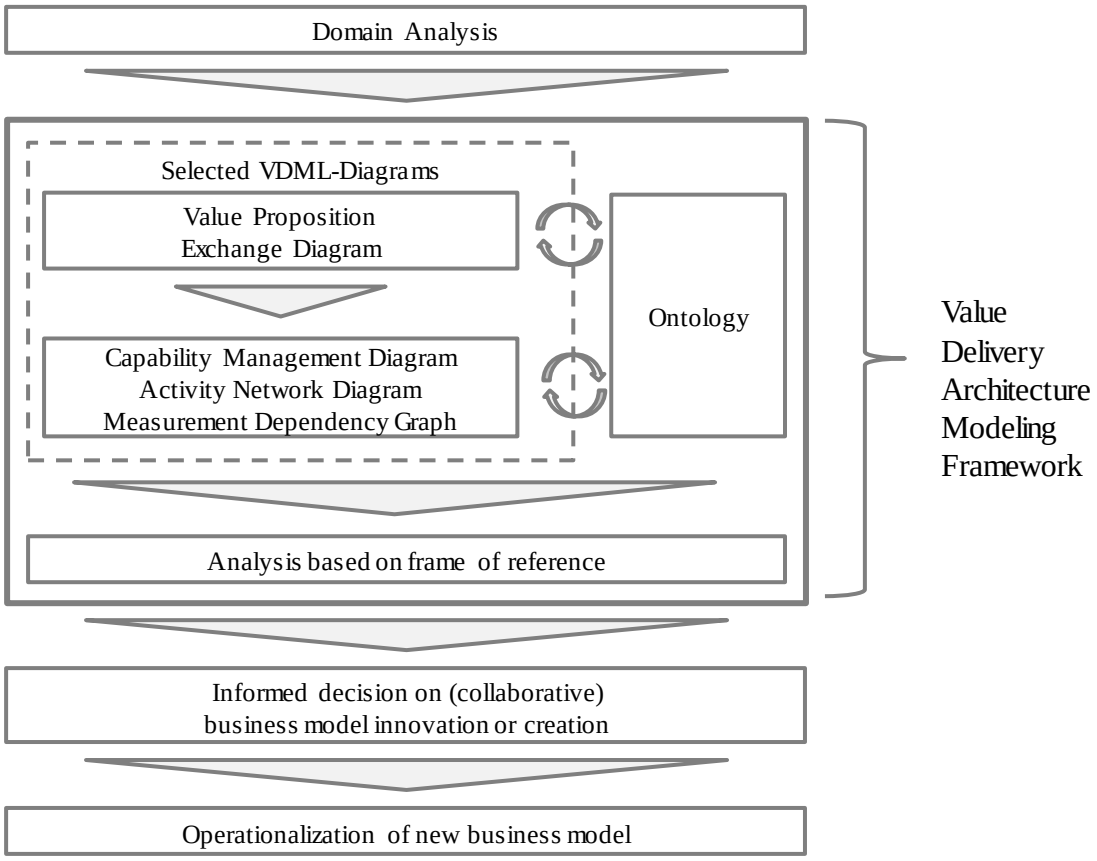


Figure 45 - The VDAM framework based on an iterative modeling and ontology building process

Domain Analysis

The process starts with gathering information about the area or industry. Following Day (1981), two approaches for such a strategic market analysis can be distinguished: top- down and bottom-up. Top-down approaches are usually in place when acting on a more strategic level, e.g. determining the competitive

advantage or resource allocation problems. Bottom-up market analysis, on the other hand, is relevant on a more tactical level, focusing on support decisions on product changes, price strategies and more (Day, 1981). Following the understanding of business models being an intermediary between strategy modeling and business process modeling, taking both perspectives (strategic and tactical) into account is consistent. Therefore, in accordance with Day (1981) and Porter (2008), various ways reaching from expert interviews, industry reports and content analysis to sophisticated quantitative data analysis are feasible for conducting an initial domain analysis as preparation for the VDAM framework. A lesson learned from the work with the approach is that when analyzing the domain and companies within the domain, modeling company specific VPED drafts has been proven useful. While these company-specific views need to be abandoned in the first step of the VDAM framework, the modeling of the VPED of a domain, these initial drafts of VPED can be considered a valuable input to this domain view.

Modeling of selected VDML diagrams

After processing and interpreting the information about a domain, it is possible to model a first version of the relevant diagrams. The initial step is always to model the Value Proposition Exchange Diagram of the domain under investigation. This diagram represents the overall value creation and delivery logic, based on roles and value propositions. For the subsequent analysis based on the diagrams, it is crucial for the model designer to leave familiar patterns or company profiles behind and focus on the essential, abstract roles. Therefore, the VDAM approach starts with an abstraction from specific companies and their individual business models and distils a representation of the overall value creation network in an existing or emerging domain. This is accomplished by modeling abstract roles, value propositions, and other elements introduced above. To facilitate discussions amongst the model designers of the business modeling team or with other stakeholders, the first iteration of the corresponding ontology should be developed. Changes in the VPED need to be recorded in the ontology elements.

After modeling a first version of the VPED, the modeling of the underlying diagrams can start. Developing additional diagram types makes use of the ontology that has emerged at that stage of the process. These diagrams, in turn, may create new questions and will trigger a process of additional empirical information gathering. The additional knowledge will be made explicit by including it in the ontology, which thereby is enriched and enhanced. In this way, the iterative ontology building and refinement process makes specific use of the extensibility guideline for ontologies (Uschold & Gruninger, 1996). Thereby, the design of the diagrams and the development of the ontology is an iterative process. Hence, the need for further diagrams can vary from business modeling project to business modeling project, dependent on their scopes.

Analysis based on the frame of reference

The underlying diagram types Capability Management Diagram, Activity Network Diagram and Measurement Dependency Graph mostly strengthen the understanding of critical capabilities, processes

and interrelating dependencies. Therefore, they allow for a more informed decision on a business model and can be seen as the link towards business process modeling, thereby facilitating the subsequent operationalization of a business model idea. The VPED, on the other hand, can be used to analyze different aspects of the decision-making process towards a new business model. The variety of analysis based on roles and value propositions is up to the model designer and the users of VDAM. Nonetheless, some commonalities between the different types of analysis do exist: as stated before, it is important for the model designer to distinguish between value propositions of companies and the roles they implicitly take on while offering them. This step of leaving specific companies behind and focusing on the more abstract level of roles and their value propositions is the foundation for creating transparency and comparability as well as the corresponding understanding and knowledge. Thereby, the VPED based on abstract roles and value propositions acts as an unbiased frame of reference for the value creation and delivery in a domain.

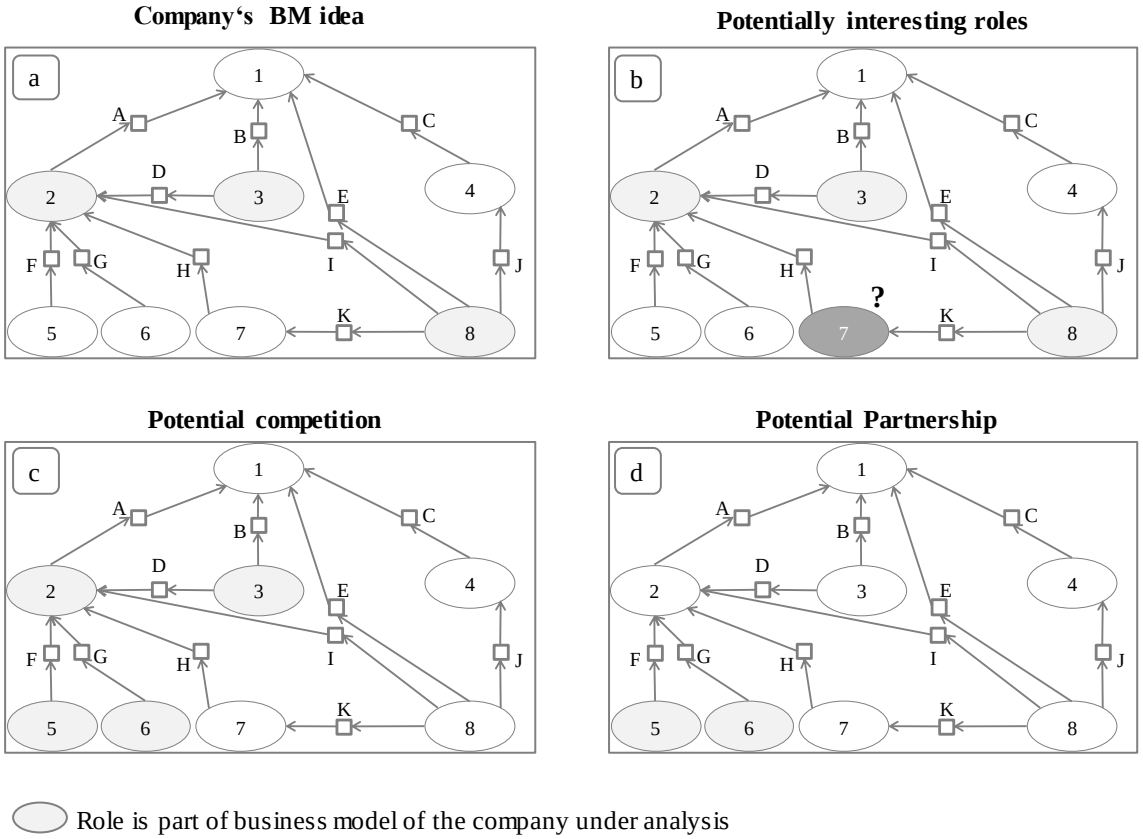


Figure 46 - Findings based on the positioning of companies in the unbiased frame of reference

This objective frame of reference of the value creation and delivery can be used to position companies in it, therefore creating transparency and comparability of their business models. To position businesses in the frame of reference, companies are assigned to roles within the network, including the own company with the new business model idea. This mapping of enterprises to roles allows:

- Analyzing the company's positioning in the value network based on the business model idea, including target roles, value propositions offered, and value propositions received (see Figure 46 diagram a).
- Detecting potential roles of interest that have not been considered in the current business model idea of the company yet or that might need to be filled by a strategic partner (see Figure 46 diagram b).
- Detecting enterprises that occupy (partially) the same roles and offers comparable value propositions, even though maybe having an altogether different focus (see Figure 46 diagram c).
- Detecting companies that might suit well as a partner because they assume important roles in the value creation network which are needed to offer the company's own value proposition (see Figure 46 diagram d).

These examples already show the potential of modeling a frame of reference based on abstract roles and the subsequent positioning of companies' business models within it. Besides these analyses based on the positioning, analysis on the value creation in general and the potential change of value creation can be conducted based on the frame of reference. As displayed in Figure 47 on the left (see diagram e), individual roles within the value network might be of increased importance, e.g. because a role integrates value propositions (D, F, G, H, and I) from a number of other roles (3, 5, 6, 7, and 8) thereby creating one value proposition (A) offered to another role (1). Understanding the strategic importance of roles in the value delivery processes can be a valuable information on how to implement a business model idea and what roles to take on.

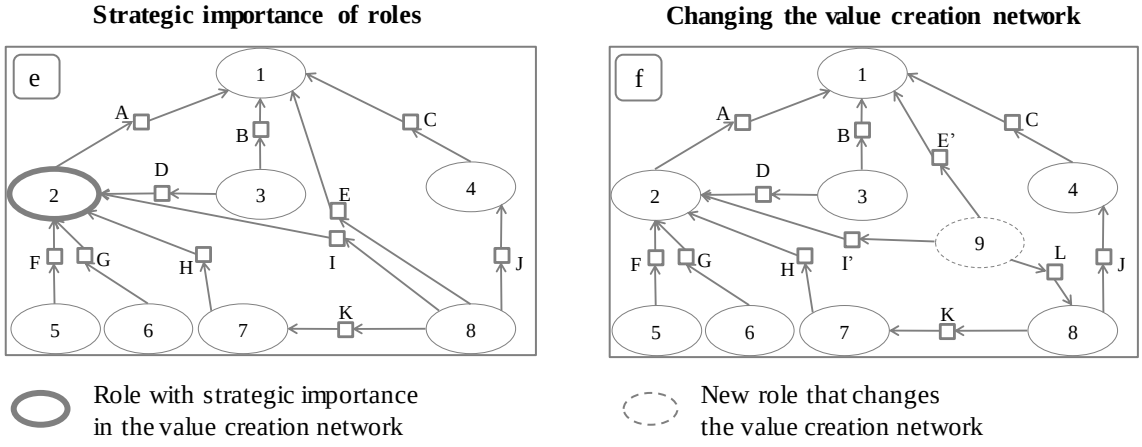


Figure 47 - Examples of analyses on value creation based on the frame of reference

Besides understanding the importance of current roles in the value network, it is also possible to analyze how the value creation and delivery process might change if a new role and new value propositions might enter the value network. As displayed on the right side of Figure 47 (see diagram f), role nine significantly

changes the value network. This role represents a new business model idea, e.g. based on a new technology that interrupts existing logics of value creation with the potential of disruptive change. Analyzing how the value network might change, helps to understand who potential future customers are, but also who potential competitors or rivals might be who feel threatened by the new business model of a company.

In conclusion, the Value Delivery Architecture Framework represents a blueprint of how to work with this new business modeling tool. The framework is based on a sound domain analysis which is subsequently used to model different types of diagrams and develop a domain ontology to further a common understanding amongst all stakeholders involved. Once the iterative process of modeling and ontology building is finished, analysis based on the frame of reference can begin. The examples of analysis illustrated above show the potential of VDAM to enable a more informed decision on if and how a new business model idea should be implemented. The approach increases transparency and facilitates a common understanding amongst stakeholders. The gained knowledge about the domain's value creation logic, especially the modeling of key capabilities, activities, and dependencies between aspects, facilitate the subsequent operationalization of the business model.

4.6 Contribution of the approach

As described at the beginning of this chapter, VDAM as an approach aims at addressing embeddedness in the supply network, creating a common understanding amongst stakeholders, and supporting the subsequent operationalization of business model ideas. These goals were determined based on the results of an extensive literature review on existing business modeling approaches (see Chapter 2.2.3), success factors for business models (see Chapter 2.2.2), and the findings of the empiric exploratory study (see Chapters 3.4 and 3.5). The VDML elements of VDAM and the corresponding ontology are combined to a comprehensive framework. This framework is based on a domain analysis, followed by an iterative modeling process of different types of diagrams, beginning with the Value Proposition Exchange Diagram. Combined with the business model ontology, this diagram represents a frame of reference for the value creation and delivery in a domain. Therefore, this diagram facilitates a common understanding among stakeholders. Additionally, by positioning a company in this frame of reference, the diagram visualizes the positioning of a company in the value network, therefore representing the embeddedness in the supply network on a more strategic level. Furthermore, this frame of reference can be used for different analyses, e.g. to determine strategically valuable roles in the value network or the effects of changing the value network based on a new business model idea. By positioning different companies in the frame of reference, further analysis concerning competition, partnerships, and coopetion can be conducted.

The more detailed types of diagrams, namely Capability Management Diagram, Activity Network Diagrams, and Measurement Dependency Graphs further the understanding of important aspects of a business

model. The Capability Management Diagram can be used to determine if there is a fit between the need for and the availability of capabilities to create and deliver a value proposition. Therefore, decisions concerning the future organizational structure as well as decisions on potential or necessary partnerships can be facilitated. Activity Network Diagrams can be used to understand fundamental processes along the value creation and delivery process at an early stage, therefore simplifying the subsequent operationalization by deepening the understanding of these processes. Measurement Dependency Graphs, on the other hand, allow understanding the relationship between different aspects of a new venture, therefore creating transparency of co-dependencies at an early stage.

In addition to explicitly describing the elements of diagrams, the ontology contains attributes with respect to value and cost. These attributes can be used to determine the financial validity of value propositions and therefore of business models. The key to this consideration of financial viability is the combination of value received, and value add. In accordance with the preferences of the model designer and the corresponding efforts taken, these considerations can be conducted on a very high level, using many assumptions, or can be carried out in much detail.

In conclusion, the VDAM artifact (VDML diagrams and the domain ontology including the allocation of cost and revenue) create an explicit frame of reference for the value creation network of a given domain. This is useful in various situations:

- It helps an entrepreneur or BMI team to clearly position and align.
- It helps to create a common understanding among stakeholders about value creation and delivery, thereby facilitating cross-company and cross-industry collaboration.
- It helps to analyze existing business models and create the basis for evaluation and (re-) design.

Key questions of entrepreneurship and strategy definition are related to these topics. They include companies' positioning in the value creation network (Song et al., 2008), competitor analysis (Porter, 2008), the identification of critical capabilities and resources (e.g. Osterwalder & Pigneur, 2010), make-or-buy decisions (Harrigan, 1985; Ouchi, 1980; Walker et al., 2000), clarity about coopetition situations (e.g. Bengtsson & Kock, 2000), the identification of key partnerships (e.g. Lindgren & Rasmussen, 2013) and more. Therefore, VDAM can make a contribution to an informed decision making in these key questions of entrepreneurial management. In the subsequent chapter, the instantiation of this new approach VDAM in the domain of fast charging infrastructure in Germany will be displayed (see Chapter 0). This chapter will show, how the VPED is used to align the different perspectives of 17 experts on value creation in the domain. This frame of reference allows to clearly position the companies in the value network (see Chapter 5.1) and creates a common understanding among the stakeholders, as the subsequent validation of the new approach will show (see Chapter 6.2). The following Chapters 0 and 6 display in detail how the VDAM approach contributes to an informed decision in the domain of fast charging infrastructure in Germany.

5 The case of fast charging infrastructure in Germany

As mentioned before, the trigger for the development of the VDAM approach is a research project on business models of fast charging infrastructure for electric vehicles (see Chapter 3). The preparation of the study and the study itself reveal some interesting facts about this new domain:

- Involvement of companies from diverse industry sectors, namely automotive, electro-technology, utilities and other services.
- Lack of a well-established value network and an ambiguous understanding of value creation due to the novelty of this area.
- Deployment of heterogeneous technological standards and proprietary solutions: CHAdeMO, CCS, and the Tesla system.
- Lack of a profitable business case for the operation of fast charging infrastructure based only on electricity sales, due to high upfront investments and a limited willingness to pay (Nationale Plattform Elektromobilität, 2014; Reinke, 2014).

Altogether, this creates a very complex and uncertain environment not favorable to direct investments and entrepreneurial engagement. The research project is motivated by the questions how to analyze the situation, how to create a conceptual framework and common understanding for the context and finally how to systematically create options for viable business models for fast charging stations (see Chapter 1.2).

In general, this chapter is displaying the instantiation of the VDAM approach and aims at presenting how the approach fulfills the assumptions towards its contribution (see Chapter 4.6). Subsequently, the different aspects of VDAM will be introduced based on the case of fast charging infrastructure. Chapter 5.1 displays the instantiation of a VPED as a frame of reference for further analysis of the domain (see Chapter 5.2). Chapter 5.3 acts as a specific example of how more detailed views can be modeled, if there is specific need to deepen the understanding of certain aspects or if the subsequent operationalization of business models shall be strengthened (see Chapter 4.6). Additionally, this chapter represents an example of how the approach can be used to evaluate business model ideas that might affect or even change the value creation network as a whole. Chapter 5.4 concludes the conducted case study in the field of fast charging infrastructure in Germany by summarizing the findings based on the VDAM approach.

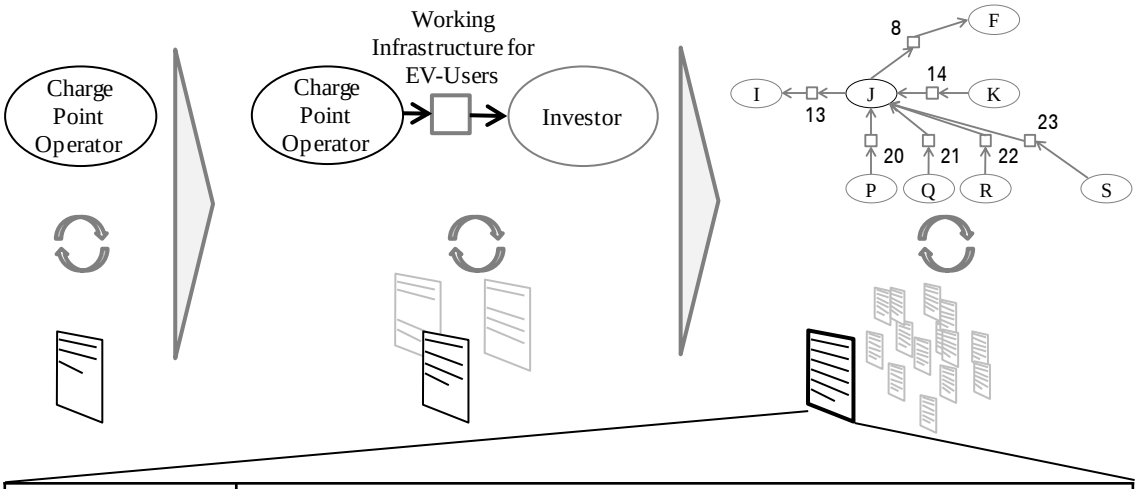
5.1 Frame of reference of the value creation network

As stated above (see Chapter 4), the Value Proposition Exchange Diagram is the key visualization within the VDAM framework. This view, combined with the corresponding ontology elements, visualizes and explicitly describes the value creation network of a particular domain from a more strategic perspective. Thereby it creates a frame of reference which allows for a common understanding amongst stakeholders. Additionally, it builds the foundation for analysis of existing business models and business model ideas (see Chapter 4.6). As part of the instantiation of VDAM in the domain of fast charging infrastructure, the exploratory study represents the underlying domain analysis, as described in the VDAM framework (Chapter 4.5). In particular, the interviews with the 17 experts (see Chapter 3.2), the systematic content analysis (see Chapter 3.3), and the subsequent modeling of the experts' individual perspectives in VDML (see Chapter 3.5) represent a solid foundation for the following steps. Based on the information derived from these sources, a consolidated frame of reference for the value creation network in the domain of fast charging infrastructure can be developed (see Chapter 5.1.1). Chapter 5.1.2 displays, how this frame of reference can be used to position companies in it, thereby creating transparency and comparability of different business models in this new domain.

5.1.1 Modeling of an overall value creation network

Applying the VDAM approach, I identified 21 different roles and the corresponding value propositions that actors (companies) can take on in the area of fast charging infrastructure. To derive these roles and value propositions, I applied the methods of abstraction (integration of roles and value propositions) and structuring (creation of new roles and value propositions) to fulfill the VDAM specific requirements for Value Delivery Exchange Diagrams. Amongst other things, these requirements encompass the restriction that only one value proposition can be offered from one role to another (see Chapter 4.2). Additionally, these methods allow to even out the different levels of abstraction used by the experts in their descriptions (see Chapter 3.6). As shown in Chapter 4.3, a semi-formal domain ontology describes all elements and their relationships to minimize the potential for misunderstanding. Thereby I develop an explicit frame of reference for the value creation network under consideration.

To illustrate the VDAM development process of a VPED in more detail, I subsequently exemplify this process with one of these roles, the so-called 'Charge Point Operator' (J) role. All experts mention the role 'CPO', but there are many different associations to what exactly this role is supposed to do (activities) and what value propositions this role is offering or receiving (see Chapter 3.5). To explicitly describe the role, a first version of the ontology entity 'CPO' (J) is developed. As displayed in Figure 48, the iterative approach of analyzing expert opinions and defining as well as visualizing roles and value propositions, the VPED is continuously growing and changing.



Name of Role	**Charge Point Operator**
Description	CPO Role (J) coordinates the Value Propositions (14, 20, 21, 22, 23) of five Roles (K, P, Q, R, S) to combine it to an overall Value Proposition (13) to the Role Investor (I). In addition it enables EMP role (F) to offer the access to the infrastructure to EV-Users via another Value Proposition (8).
Example	Company C takes on the CPO Role for BMW-owned charging stations on semi-public BMW property, e.g. dealerships. Thereby C provides all necessary operations. In addition C enables the EMP ChargeNow to access these charging stations via RFID card.
Actor	(public) Utilities, Service Industry
Target Role	True
Received Value Proposition from Offering Role	▪ HOTLINE FOR EV-USERS AND EMPs (14) from CALL CENTER (K) ▪ HIGH REACH OF CUSTOMERS FOR LOW TRANSACTION COSTS (23) from ROAMING PLATFORM (S) ▪ CHARGEPOINT MANAGEMENT (22) from IT OPERATOR CHARGEPOINT MANAGEMENT (R) ▪ MAINTENANCE AND REPAIR (21) from TECHNICAL OPERATOR (Q) ▪ ENERGY (20) from ENERGY SUPPLIER (P)
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ WORKING INFRASTRUCTURE FOR EV-USERS (13) to INVESTOR (I) ▪ ACCESS TO CHARGEPOINTS (8) to EMP (F)
Expected Value to Target Role	

Figure 48 - Example of the iterative process of visualization and ontology building in VDAM

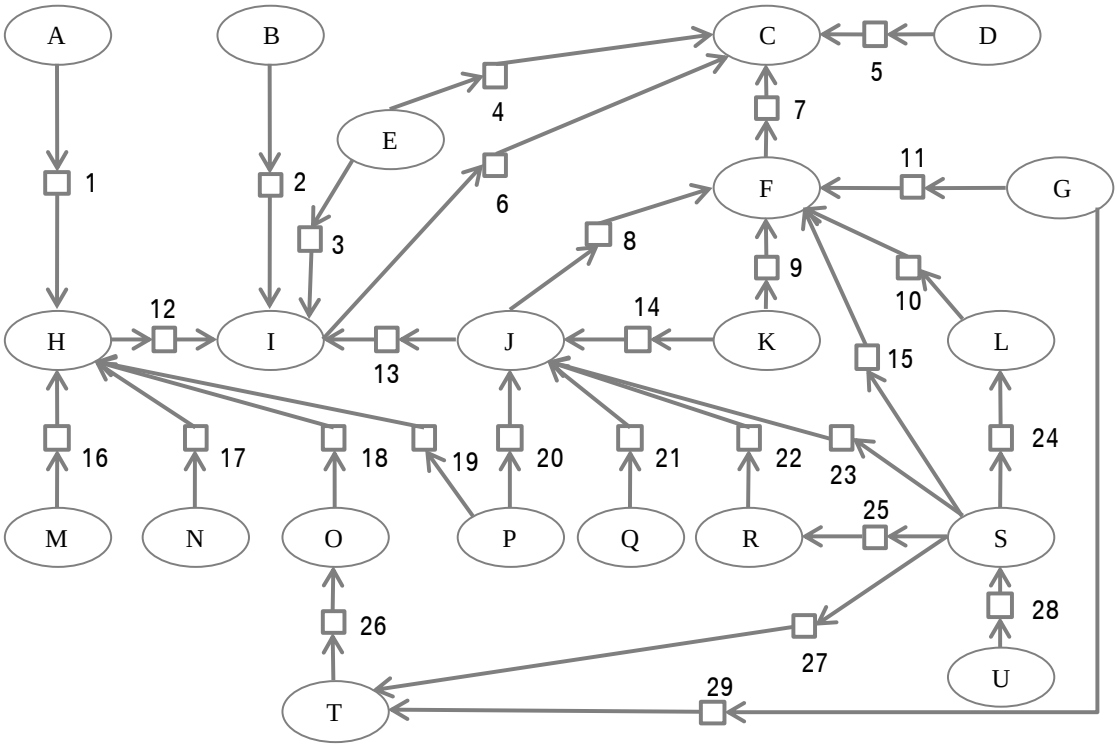
Simultaneously, the corresponding ontology element of the role 'CPO' (J) becomes more detailed and other related ontology entities can be described. Thus, the desired unambiguous understanding of elements, as well as a visualization of the corresponding value creation and delivery, is created. In the case of fast charging infrastructure, it becomes evident that the role 'CPO' is mainly organizing the actual operations of charging infrastructure by coordinating several roles as well as their value propositions and offering the

result to the role 'Investor' (I). Also, a second value proposition offers 'Access to Charging Points' (8) to the role 'EMP' (F).

In several iterations, a consolidated view of the complex overall value creation network in the domain of fast charging infrastructure emerges (see Figure 49). This view includes 21 roles and 29 value propositions. In the case of fast charging infrastructure it becomes apparent that even though the VDAM approach reduces heterogeneity resulting from disparate views, it also maps the real complexity of the situation.

On the left-hand side of this diagram, roles active in the development and installation of fast charging infrastructure are displayed. The key to this part of the diagram is the 'Setup Organizer' role (see role H in Figure 49). This role coordinates the value propositions of several other roles that are part of the value creation for the 'Investor' role (I). Besides the 'Attractive Charging Location' (1) offered by the 'Location Provider' role (A), the 'Setup Organizer' role (H) is responsible to find and purchase the appropriate infrastructure from the 'Charging Station Seller' role (O) that receives the fast charging stations from the role 'Charging Station Manufacturer' (T). The appropriate infrastructure needs to be in accordance with the available 'Power Supply' (19) at the charging location, offered by the 'Energy Supplier' (P). Additionally, the role 'Setup Organizer' (H) needs to ensure that the physical installation is conducted by the 'Installer' role (N) and that all necessary 'Permission and Licenses' (16) are acquired. Thereby, the role 'Public Authorities' (M) is an abstraction to several possible municipal authorities, such as the public construction authorities. This abstraction and thereby simplification is feasible because this aspect of fast charging installation is handled differently from state to state and sometimes even city to city. Nonetheless, as Expert B8 said, this aspect is highly important, often time-consuming, and seems to be underestimated by many. Therefore, this point was included on a more abstract level, to emphasize its importance without adding unnecessary complexity. Additionally, the role 'Government' (B) is of importance for the installation of fast charging infrastructure. As stated above, experts see no or only very little opportunity for the financial viability of business models concerning the installation and operation of fast charging infrastructure due to the related very high initial costs (see Chapter 3.4). Therefore, the value proposition 'Subsidies' (2) offered by the role 'Government' (B) is highly important for the value network in this domain.

Looking at the operations of fast charging infrastructure, the role 'Roaming Platform' (S) offers several value propositions, while only receiving the value proposition 'Working Roaming Platform' (28) from the role 'IT Operator Roaming Platform' (U). These two roles have to be split because companies that occupy the 'Roaming Platform' role (S) not necessarily take responsibility for the technical operation of the platform but outsource it to other companies. Therefore, the role 'Roaming Platform' (S) focusses on value propositions based on a 'Working Roaming Platform' (28), offered by the role 'IT Operator Roaming Platform' (U). The role offers versions of 'Declarations of conformity' (24, 25, 27) to the roles 'IT Operator of EV- User Management (L)', 'IT Operator CS Management' (R), and Charging Station Management' (T).



Roles

A) Location Provider
B) Government
C) EV- User
D) EV- Manufacturer
E) Cross Seller
F) Electric Mobility Provider
G) Access Technology Provider
H) Setup Organizer
I) Investor
J) Charge Point Operator
K) Call Center
L) IT Operator EV- User Management
M) Public Authorities
N) Installer
O) Charging Station Seller
P) Energy Supplier
Q) Technical Operator
R) IT Operator CS Management
S) Roaming Platform
T) Charging Station Manufacturer
U) IT Operator Roaming Platform

Value Propositions

1) Attractive Charging Location
2) Subsidies
3) Cross Financing
4) Shopping Opportunities
5) CCS-Readiness of EVs
6) Customer-friendly Fast Charging
7) Customer-friendly Access to CS
8) Access to CS
9) Hotline for EV- Users
10) Customer Management
11) Working Access Technologies
12) Turnkey Solution for CS
13) Working Infrastructure for EV- User
14) Hotline for EV- User and EMPs
15) High Number of CS for Low Transaction Costs
16) Licenses and Permissions
17) Installed Infrastructure
18) Appropriate Infrastructure
19) Power Supply
20) Energy
21) Maintenance and Repair
22) CS Management
23) High Reach of Customers for Low Transaction Cost
24) Declaration of Conformity for EV- User Management
25) Declaration of Conformity for CS Management
26) Fast Charging Stations
27) Declaration of Conformity for Fast Charging Stations
28) Working Roaming Platform
29) Access Technologies for CS

Figure 49 - VPED of the fast charging infrastructure domain in Germany

These 'Declarations of Conformity' (24, 25, 27) state that the IT- systems and the charging technology are compatible with the roaming platform. Additionally, the role offers economies of scale to the roles 'Charge

Point Operator' (J) and 'EMP' (F) by increasing their reach of end-customers and the number of accessible charging stations.

In this context, the role 'Charge Point Operator' (J) conducts mostly organizational tasks of organizing and combining the value propositions of other roles. Besides the before mentioned value proposition offered by the role 'Roaming Platform' (S), value propositions from the roles 'Call Center' (K), 'Energy Supplier' (P), 'Technical Operator' (Q), and 'IT Operator CS Management' (R) are combined to value propositions offered to the roles 'Investor' (I) and 'EMP' (F). The role 'EMP' (F), on the other hand, receives 'Access to CS' (8) from the role 'Charge Point Operator' (J) and 'High Number of CS for Low Transaction Cost' (15) from 'Roaming Platform' (S). Additionally, the roles 'Call Center' (K), 'IT Operator EV- User Management' (L), and 'Access Technology Provider' (G) offer value propositions. 'Access Technology Provider' (G) provides the technical link between the 'Charging Station Manufacturer' (T) and the 'EMP' (F). The role 'EMP' (F) combines these various value propositions to one overall value proposition of 'Customer-friendly Access to CS' (7), offered to the role 'EV- User' (C). This role receives further value propositions from other roles, namely from 'EV- Manufacturer' (D), 'Cross Seller' (E), and 'Investor' (I). The latter offers the value proposition 'Customer-friendly Fast Charging' (6) and bears the financial risk of installation and operation of fast charging infrastructure. While paying for the value propositions provided by the roles 'Setup Organizer' (H) and 'Charge Point Operator' (J), these high initial and reoccurring cost of installation and operations are only lowered by the 'Subsidies' (2) offered by the role 'Government' (B) and 'Cross-Financing' (3) by the role 'Cross- Seller' (E). To make a business model viable for the 'Investor' role (I), the value proposition 'Customer-friendly Fast Charging' (6) needs to create a certain amount of revenue.

Therefore, this view incorporates all statements made by the experts towards value propositions and roles and allows to display all mentioned role occupations by the experts (see Chapter 5.1.2). Nonetheless, to ensure a consolidated view, the before mentioned methods of abstraction and structuring are applied. Abstraction occurs mainly concerning value propositions, to comprise with the requirement defined for this view that only one value proposition might be offered from one role to another. Structuring is mainly necessary to depict different combinations of role occupation by companies and their partners. While including all heterogenic expert perspectives into one consolidated view, the frame of reference shows the real complexity of this new domain of fast charging infrastructure. Thereby, the frame of reference is fostering transparency for the analysis on if or how business model ideas can be implemented in this new domain and is creating shared understanding amongst stakeholders.

It is interesting to notice that the level of granularity of the value creation network is not something absolute, but depends on the context. As an example, an 'EV Manufacturer' (D) is part of a very complex supply network that does not appear in this model. In contrary, the EV is considered as a whole. Depending on the business model in question, various levels of aggregation may make sense. In the context of fast

charging infrastructure, the interview statements of the experts determined the degree of granularity of the representation. In any case, VDAM has the flexibility to capture further details and extend the framework if needed.

5.1.2 Positioning of companies in the frame of reference

As stated above, the frame of reference of a particular domain can be used to create transparency and a common understanding amongst stakeholders (see Chapters 4.5, 4.6, and 5.1.1). An important aspect of this transparency is the possibility to create comparability of business models of different companies, partners, and competitors, likewise. This is achieved by the positioning of enterprises in the frame of reference based on the VPED via linking of actors (companies) to roles. The positioning of companies within the frame of reference based on abstract but clearly defined roles allows leaving behind company specific terms and definitions.

Figure 50 demonstrates the general process of linking roles to actors (that is specific companies) based on the domain analysis. This domain analysis is, in this case of installation and operation of fast charging infrastructure, based on expert statements derived in the empiric explorative study (see Chapter 3.5). In these diagrams, four types of role occupation are displayed (see Table 10): ovals with a thin border and a white background represent roles that exist in the value network but neither strategic partners nor the company itself are occupying it. Ovals with a thick border and a white background represent roles assumed by strategic partners. Ovals with a thin border and that are shaded gray represent roles taken on by the experts' company. Ovals with a thick border and a gray background display roles occupied by the company and at least one strategic partner.

Table 10 - Positioning of companies in the frame of reference – four types of role occupation

	White background	Grey background
Thin boarder	 Neither company nor strategic partner occupy this role	 Role occupied by the Experts' company
Thick border	 Role occupied by at least one strategic partner	 Role occupied by the company and at least one strategic partner

In the displayed example (see Figure 50), the pictogram on the top left shows the value network described by Expert B1. It contains nine roles. In her perspective on roles and value proposition in the domain of fast charging infrastructure, her company takes on the roles 'EV- Manufacturer' (IV), 'Location Provider' (I),

'EMP' (VIII), and 'Investor' (VI). Based on her statements, the roles 'Charge Point Operator' (VII), 'Call Center' (IX), and 'Installer' (VI) are assumed by strategic partners. After deriving the frame of reference for the domain of fast charging infrastructure (see Figure 49 and pictogram on the top right of Figure 50), it is possible to allocate her perspective in that consolidated view (see pictogram on the bottom of Figure 50).

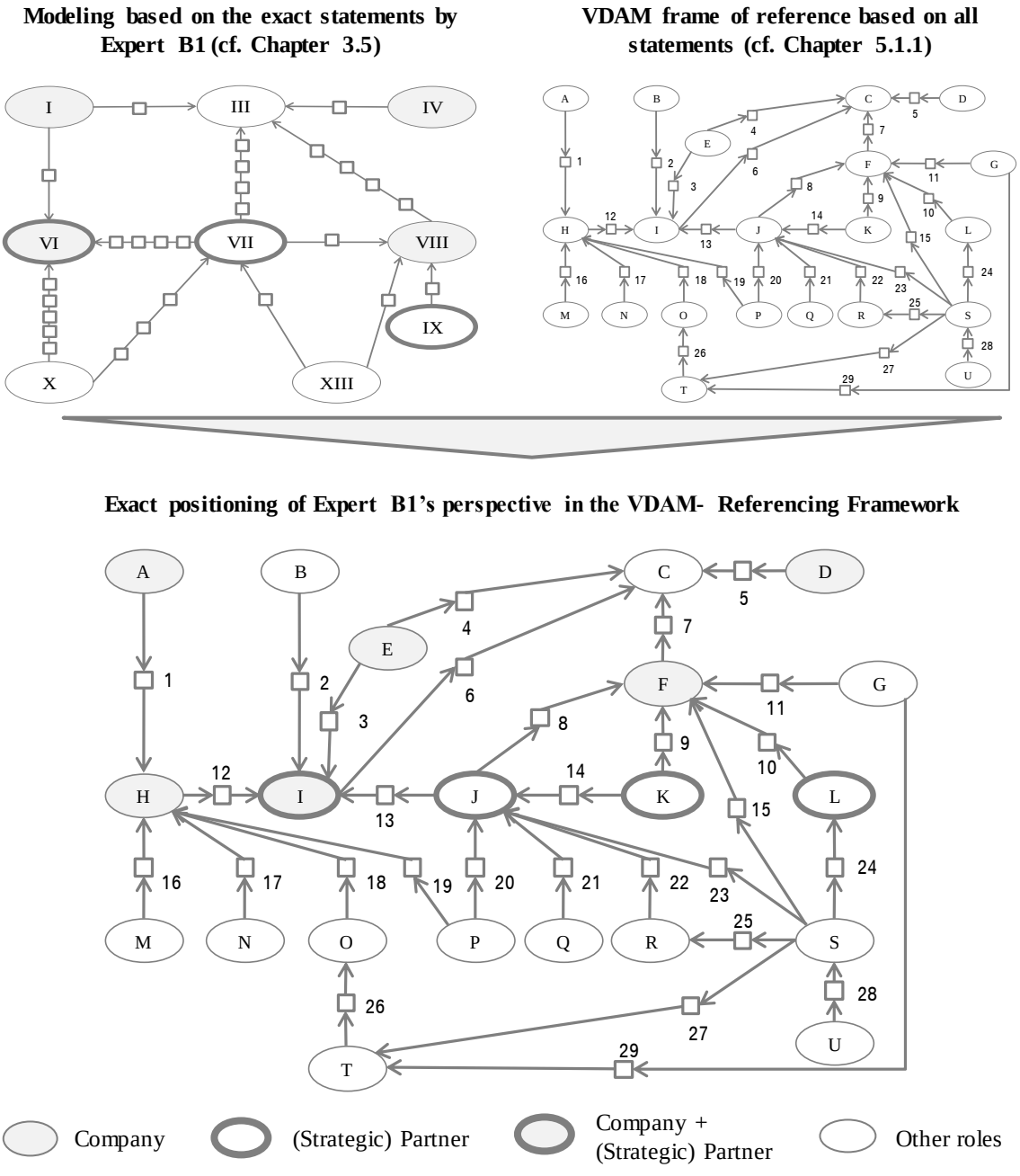


Figure 50 - Example of the positioning process of individual business models in the VPED

Within the consolidated VDAM frame of reference her company is not occupying four roles as she stated in the interview but in fact, is filling six roles. In her definition of roles and value proposition (see top left of

Figure 50), the ‘Location Provider’ role (I) is offering shopping opportunities to the ‘EV- User’ (III). In the frame of reference (see top right of Figure 50), a discrete role called ‘Cross Seller’ (E) offers this value proposition.

Similarly, based on the statements by Expert B1, her company invests in infrastructure and organizes the installation of the fast charging station, both as part of the ‘Investor’ role (VI).Within the VDAM frame of reference for this domain, these are two separate roles: ‘Investor’ (I) and ‘Setup Organizer’ (H). Therefore, besides the four roles stated above, the roles ‘Cross Seller’ (E) and ‘Setup Organizer’ (H) are occupied by Expert B1’s company. Additionally, instead of only three roles that are assumed by strategic partners, the role ‘IT-Operator EV- User Management’ (L) is taken on by a strategic partner as well.

By following this approach of placing business model views of individual experts into the VDAM frame of reference, a comparison of business models becomes possible (see Figure 51). This is a foundation for various types of analysis (see Chapter 5.2). Additionally, understanding what roles competitors, partners and other companies in the value network assume, allows for a more informed decision on partnerships. All these aspects are key to prepare informed decisions on if and how a new business model should be implemented or if the existing business model needs to be innovated. The subsequent Chapter 5.2 displays a detailed analysis based on the frame of reference for the domain of fast charging infrastructure in Germany.

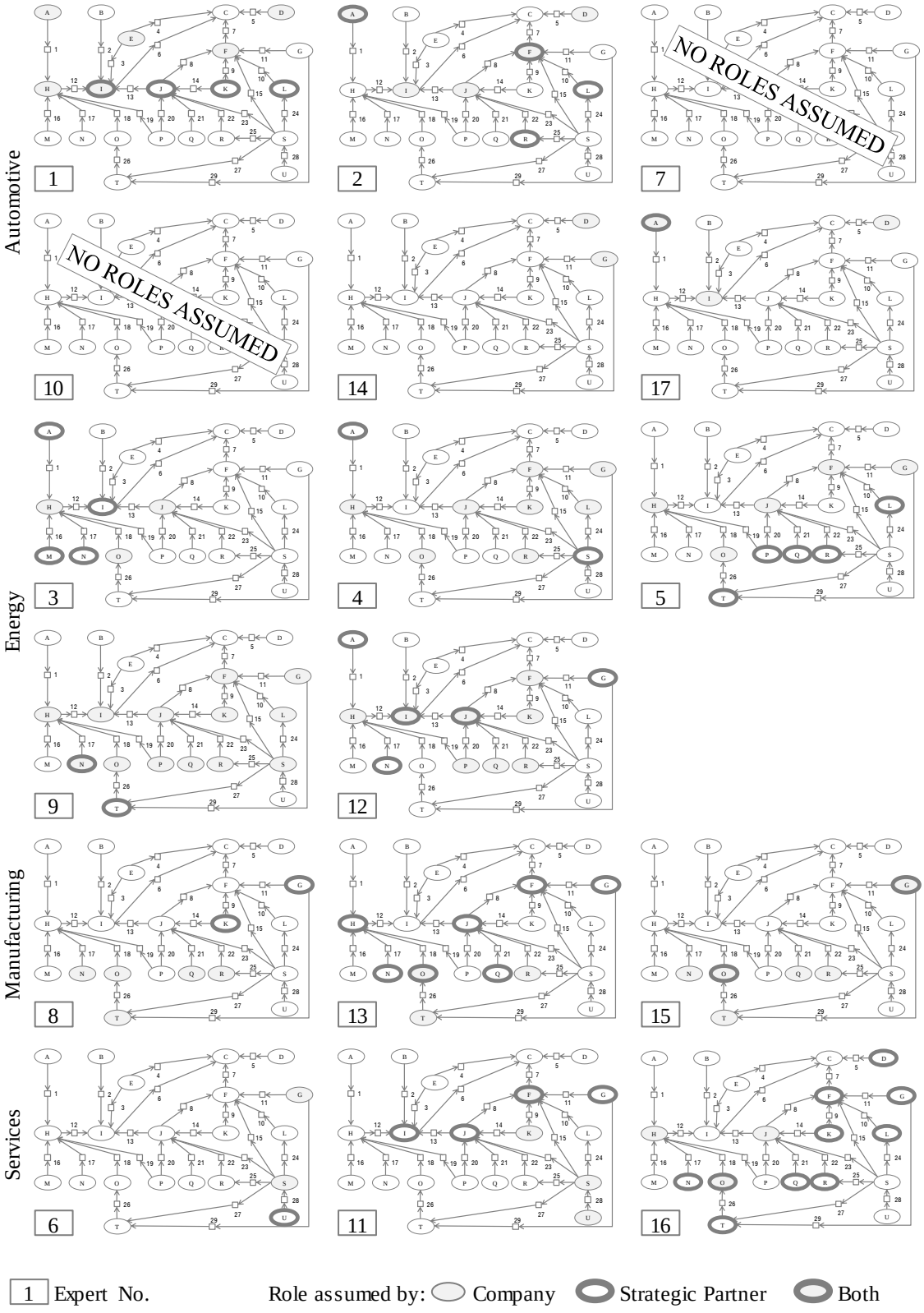


Figure 51 - Positioning of the experts' companies and strategic partners in the frame of reference

5.2 Analysis of value creation and business models based on the frame of reference

As mentioned above, the VDAM framework allows developing a frame of reference that can be used for several analyses, fostering transparency and an informed decision on if and how to implement a business model. Subsequently, several approaches to analysis are introduced. These represent examples of the potential for analysis that the frame of reference and the positioning of companies in this frame of reference are offering. In the following, potentials of analysis solely based on the visualization and description of the value network are displayed in Chapter 5.2.1. This is followed by different types of analysis based on the positioning of companies within the frame of reference, beginning with the overall competitiveness of roles (see Chapter 5.2.2). Subsequently, in Chapter 5.2.3, the comparison of company positioning with and without respect to their original industry affiliation are conducted. This chapter concludes with a combination of the findings based on these examples of different types of analysis (see Chapter 5.2.4).

5.2.1 Analysis of roles in the value network based on the frame of reference

While analyzing the roles in the value creation network displayed in the VPED, the positioning of specific companies in the network is not considered. By examining the roles in the value creation network (see Figure 49), the understanding of value creation in a domain can be deepened and potentials for business model opportunities can be detected. Looking at the roles in the area of fast charging infrastructure in Germany several insights about this emerging industry are revealed.

By looking at what type of businesses the roles are conducting, it becomes apparent that only one role can be assumed by end-customers, namely the role ‘EV- User’ (C). Following this insight, it becomes evident that four roles, namely ‘EV- Manufacturer’ (D), ‘EMP’ (F), ‘Investor’ (I), and ‘Cross-Seller’ (E) are occupying the B2C interface by offering a direct value proposition for the role ‘EV- User’ (C). All other roles seem to focus on the B2B-business. Additionally, there are two roles which can be placed into the public or governmental sector, namely ‘Public Authorities’ (M) which offers ‘Licenses and Permissions’ (16) to the role ‘Setup Organizer’ (H) and ‘Government’ (B) which provides ‘Subsidies’ (2) to ‘Investor’ (I). These roles do not necessarily have the intrinsic motivation to generate a positive business case, but, at least in the case of the role ‘Setup Organizer’ (H) as the receiving role, might cause expenses, nonetheless.

By analyzing the number of incoming value propositions, it becomes apparent that several roles have a much higher level of interrelatedness than others. These roles are characterized by coordinating and thereby combining a large number of value propositions from other roles to integrate them to one or two new value propositions subsequently. As displayed in Figure 52, these roles are acting as hubs, adding value

by system design, structuring, orchestrating, or even controlling the otherwise highly complex value network (Huemer, 2006). Examples in the area of fast charging infrastructure are 'Setup Organizer' (H), 'Charge Point Operator' (J), 'EMP' (F), and 'Investor' (I). Two of these roles have a significant impact on facilitating the level of engagement of the role 'Investor' (I) by coordinating a high number of value propositions of other roles and offering a combined value proposition. 'Setup Organizer' (H) acts as some type of general contractor for the installation process, offering 'Turnkey Solutions for CS' (12) by coordinating and combining the value propositions of five different roles. Therefore, this role creates value by determining an attractive location for a fast charging station, finding the right charging station type, organizing the power supply and the subsequent installation while all permission and licenses are granted. The role 'CPO' (J) on the other hand is coordinating all value propositions necessary to offer 'Working infrastructure for EV- User' (13) to 'Investor' (I), enabling this role to provide 'Customer-friendly Fast Charging' (6) to 'EV- User' (C). Hence, 'CPO' (J) ensures that sufficient energy is available for operations and that maintenance and repair are conducted when necessary. Additionally, this role ensures that authentication and billing are possible and that the charging stations can be accessed via the value proposition of the role 'EMP' (F). Therefore, these two roles enable actors (companies) to focus on the 'Investor' (I) role, in case some companies don't want to take over installation or operation by themselves.

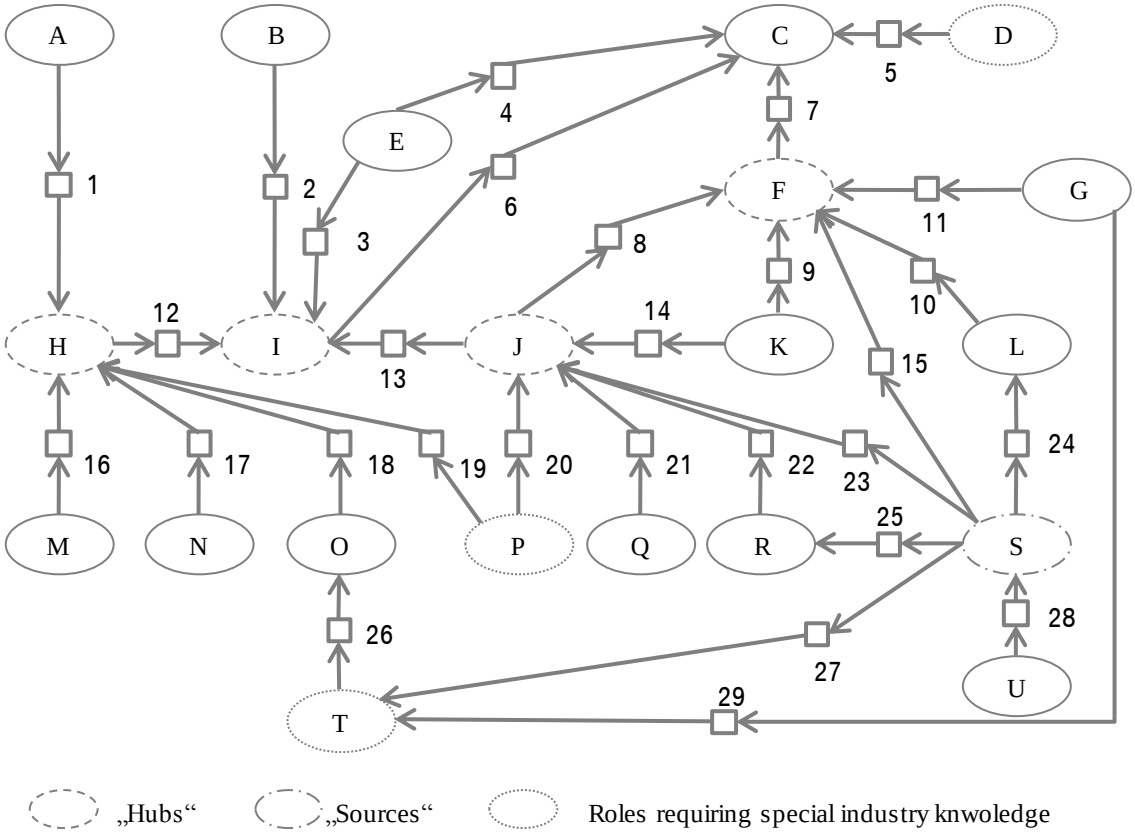


Figure 52 - Roles with special importance or requirements in the value network of the domain

Analyzing the number of outgoing value propositions, the role 'Roaming Platform' (S) stands out and seems to be of particular importance in the value network. Mostly, it offers value propositions to roles that are engaged in the operations of fast charging infrastructure. Additionally, it offers the value proposition 'Declaration of Conformity Fast Charging Station' (27) to the role 'Charging Station Manufacturer' (T), which is only active as part of the installation process within the value network. In sum, this role is highly interconnected and can be characterized as a source of value propositions (see Figure 52). Other roles such as 'EV- Manufacturer' (D), 'Charging Station Manufacturer' (T) or 'Energy Supplier' (P) add value to the system by offering value propositions that base on particular expertise and capabilities from the respective industry types, namely automotive, electro-technology, and energy sector.

By simply analyzing the frame of reference, certain interesting facts can be derived:

- The value network incorporates roles that act as hubs, namely 'Setup Organizer' (H), 'Charge Point Operator' (J), 'EMP' (F), and 'Investor' (I). They structure the otherwise manifold value propositions.
- The structuring conducted by the roles 'Setup Organizer' (H) and 'Charge Point Operator' (J) enables Actors without technical expertise or domain background to become part of this value network as 'Investor' (I).
- The role 'Roaming Platform' is offering value propositions to five different other roles and therefore seems to be of particular relevance in the value network as well.
- Some roles seem to need specialized knowledge, capabilities, and expertise from certain industry backgrounds, e.g. the role 'EV-Manufacturer' (D).

5.2.2 Analysis of role assumption and strategic partners

Aforesaid, the positioning of companies in the frame of reference by assigning actors (companies) to roles allows for several types of analysis that enable a more informed decision on if and how to implement a business model (see Chapter 5.1.2). In this context, an analysis on how many companies are assuming certain roles can be an indicator of the competitiveness that a company will be challenged with when engaging in this domain. Subsequently, interesting findings concerning the competitiveness of roles are displayed and interpreted. Thereby it is important to notice that, at the point of analysis, two companies from the automotive industry do not assume any role in the value network, even though they take part in Nationale Plattform Elektromobilität, other brain trusts, and government funded projects (see Chapter 3.2). Therefore, the maximum number of companies that can take on a role is 15 instead of 17.

The role assumed by most companies is 'Charging Station Seller' (O). This is remarkable because only three of the interviewed experts stated that their company is providing charging infrastructure technology (role 'Charging Station Manufacturer' (T)). This fact shows that the role 'Charging Station Seller' (O) offering a

value proposition to the role 'Setup Organizer' (H) is appealing to companies from industries other than technology providers. The roles 'CPO' (J), 'Setup Organizer' (H), and 'EMP' (F) rank second. A high number of receiving value propositions characterizes these roles. These value propositions received are coordinated and combined to be offered as a single value proposition, or in the case of 'CPO' (J), as two value propositions. Therefore, these coordinating roles are appealing to actors from different industries as well, and therefore reach a relatively high level of competitiveness.

Looking at the roles which only a few experts mentioned, it becomes apparent that only one expert stated that her company is filling in the role 'Cross Seller' (E). This is noteworthy because this is one of only four roles that have a direct value proposition to 'EV- User' (C) and therefore is active in the B2C business (see Chapter 5.2.1). Considering the experts' statements concerning the profitability of installation and operation of fast charging infrastructure only five of their companies are assuming the 'Investor' (I) role.

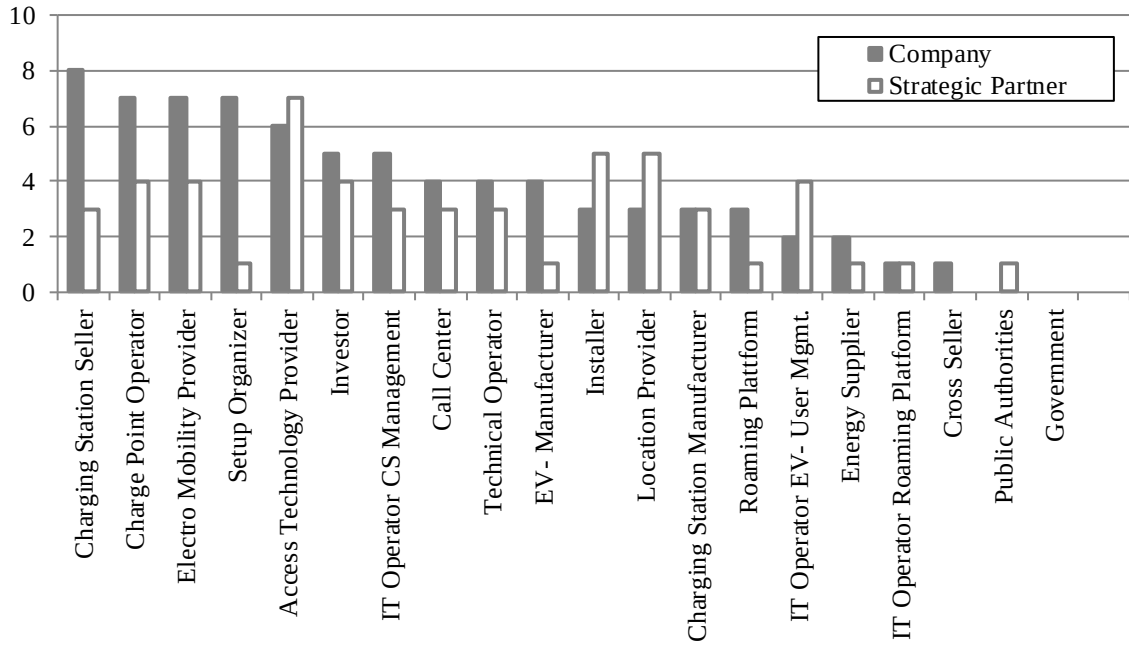


Figure 53 - Roles assumed by experts' companies and roles assumed by their respecting partners

Analyzing the roles that need a specialized industry background, namely 'Charging Station Manufacturer' (T), 'EV-Manufacturer' (D), and 'Energy Supplier' (P), some additional findings can be revealed. For example, it is interesting to notice that not all companies with an energy background stated that they are assuming the 'Energy Supplier' role (P) but take on different roles in the network. For the other roles, the companies with the respective industry background take on their roles, if they participate in the domain at all.

Looking at the number of statements towards roles that are assumed by partners of the companies, it becomes evident that the role 'Access Technology Provider' (G) is of great importance to many actors. This role profits from the fact that its products and the corresponding value propositions build the technological interface which enables 'EV- User' (C) to authenticate at charging stations. Focusing on the other end of the spectrum, only one expert mentioned the roles of the public or governmental sector as partners. This is noteworthy because offering the necessary 'Licenses and Permissions' (16) as well as the 'Subsidies' (2) would have been assumed worthy to maintain a close relationship with the offering roles.

While the analysis of roles in the value network based on the frame of reference shows that the role 'Roaming Platform' (S) offers value propositions to five other roles, only one expert from a company not assuming this role calls it a strategic partner. The fact that 'EV-Manufacturer' (D) does also just get mentioned by one expert is astonishing because the value proposition 'CCS-readiness of EVs' (5) is essential to the system as a whole. Additionally, there are still some interoperability challenges between EVs and the infrastructure. Therefore the mentions of 'EV-Manufacturer' (D) were expected to be higher. Besides that, most roles got mentioned as partners three to five times which supports the interrelatedness of roles and the complex value creation network in this domain.

As stated in Chapter 5.2.1 the roles 'Setup Organizer' (H) and 'CPO' (J) are important for the field and enable companies without any expertise in this new domain to take part by assuming the role of an 'Investor' (I). Additionally, as the analysis above shows, these roles are occupied by seven different companies, each. As Figure 54 displays, some interesting facts about the combination of roles can be revealed: In total 9 of the 15 experts' companies assume at least one role of this triplet. Just one company, a company with a service industry background takes on only one role, namely the role Investor (I). All other companies fill in at least two roles. The most common combination is to assume the role of 'CPO' (J) and 'Setup Organizer' (H). Six of the nine companies occupy at least these two roles, which indicates that it is an interesting combination of roles for companies to take on.

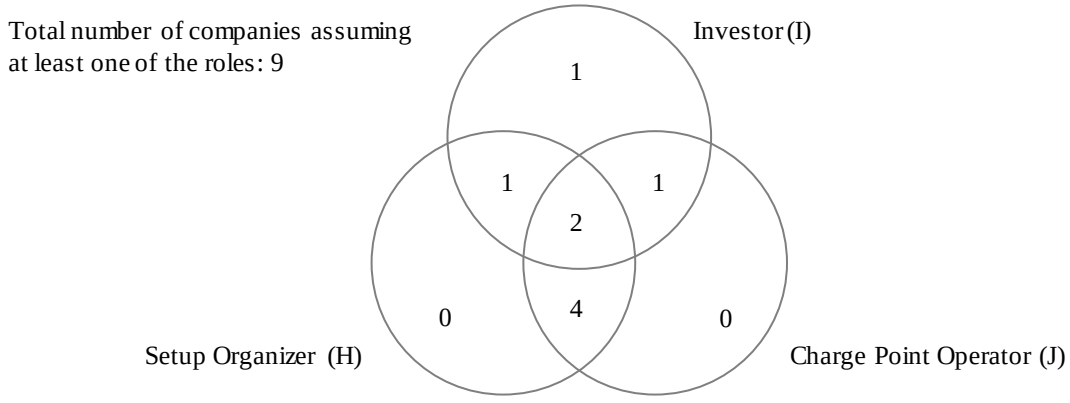


Figure 54 - Combination of roles assumed: Setup Organizer, Investor, and Charge Point Operator

The analysis of role occupation and strategic partnerships reveals several interesting facts about this new domain:

- The role occupied by most companies is 'Charging Station Seller' (O) even though only three companies actually develop and produce charging stations.
- While the role 'EMP' (F) with a direct value proposition towards the 'EV- User' (C) is assumed by many companies, the role 'Cross Seller' (E) is only assumed by one.
- Only five of the fifteen companies active in the domain are currently willing to take on the role 'Investor' (I).
- While three companies assume the role 'Roaming Platform' (S) only one other company considers them a strategic partner, even though it offers value propositions to 5 other roles
- If a company takes on the role 'Setup Organizer' (H) or 'CPO' (J), 6 out of 8 times it assumes the other role as well.

5.2.3 Analysis and comparison of the positioning of companies

After describing ways to analyze the overall value creation network and the role occupation within, the focus of analysis now shifts towards the positioning of individual enterprises in this new domain. Firstly, the industry background of the companies analyzed is taken into consideration, leading to knowledge about different levels of participation in this new domain. Additional findings concerning the business models of companies, in general, follow next.

Starting with an analysis of companies from the automotive industry, statements of six experts can be compared based on the VDAM frame of reference for the domain of fast charging infrastructure in Germany (see Figure 51). Companies from the automotive industry show very diverse levels of engagement in this new domain. Interestingly, even the two experts from the same automotive company (expert B1 and expert B2) have different perceptions of which roles are filled by their employer. Nonetheless, they agree that their company assumes all roles with direct contact to 'EV- User' (C), thereby offering a holistic value proposition to this role. Other enterprises of the automotive industry show much less engagement in the area of fast charging infrastructure. Two experts stated that their company does not fill any role in the value creation network at the moment, not even 'EV-Manufacturer' (D) with the value proposition 'CCS-fast charging readiness of EVs' (5). The other two companies focus on their role as 'EV-Manufacturer' (D), taking little interest in other roles. One of these two companies is active as 'Access Technology Provider' (G) because the firm implemented Power Line Communication as an authentication technology into their cars. The other one assumes the role 'Location Provider' (A). Based on the statements of the experts, two of the three companies from the automotive industry that are active in this domain act, on a limited scale, as 'Investors' (I).

Looking at the companies from the energy sector, it becomes apparent that all of them take on the roles 'Charge Point Operator' (J) and 'Setup Organizer' (H). Only two of five companies do also act as 'Investors' (I) themselves. Besides that, four out of five companies are active as 'EMP' (F). Therefore, enterprises of the energy sector are highly active in three of the coordinating roles mentioned above. Additionally, four out of five companies fill the role 'Seller of Charging Stations' (O). Besides these key roles within the value network, the companies' engagement varies considerably. While three of the companies with an energy background assume eight roles or more, the other remaining two companies have a broad network of strategic partners. Remarkably, according to the expert statements, only two of the five companies act as an 'Energy Supplier' (P) in the value network.

Companies from the electro-technology area are active as 'Charging Station Manufacturers' (T), 'Technical Operators' (Q), and 'IT Operators Charging Station Management' (R). Thereby, they offer a holistic value proposition for fast charging stations. All of them take on the role 'Seller of Charging Stations' (O), but also have partners to support their engagement in this role. For all companies 'Access Technology Provider' (G) is another important partner. In general, electro-technology companies tend to focus on roles close to their primary industry and area of expertise and show only little engagement in other parts of the complex value network.

The picture of the companies from the service sector is more diverse. Two of the three enterprises of the service industry are active in the role 'Roaming Platform' (S) and closely related roles, focusing on the B2B business. One of the two companies is acting as 'EMP' (F) as well, thereby expanding its reach towards the B2C business. Out of the perspective of this expert, her company has a widespread network of strategic partners in many of the roles that it is offering value propositions to. Interestingly, this feeling of strategic partnership seems to be one-sided, because only one expert mentioned 'Roaming Platform' (S) as a strategic partner (see Chapter 5.2.2). The third company from this industry focuses on the roles with access to 'Investor' (I). This company can offer these highly complex value propositions 'Turnkey Solutions of Charging Infrastructure' (12) and 'Working Infrastructure for EV- Users' (13) by having a widespread net of partners in all essential roles. Thereby this company needs the capabilities 'Integration' and 'Coordination', as well as 'Project Management' to fulfill its value propositions.

Looking at the companies in total, some additional findings are revealed: In general, primarily companies from the automotive and the energy sector compete for access to the 'EV- User' (C). Especially the role 'EMP' (F) is of particular interest to companies from both industries, as the occupation rate for this role shows. Other roles with a relatively high degree of competition are the roles with direct value propositions to the 'Investor' (I). Mainly companies from the energy sector fill these roles but there is competition from companies from other industries, e.g. services as well. A role with little competition is 'Cross-Seller' (E). Even though this role has a direct value proposition to 'EV- User' (C), only one expert states that her

company fills this role and no other expert mentioned this role as a partner. Even less attention is given to the public or governmental roles as partners. This is a surprise due to the complexity of regulations for installing fast charging infrastructure and the general calling for subsidies as an initial aid for the implementation of fast charging infrastructure in Germany. The willingness to act as 'Investor' (I) is relatively low. Only five of the experts state that their company assumes this role, mostly with a relatively low level of engagement. All other companies only want to participate in the market without bearing the risk of high investments. Additionally, the perception that some roles need special industry backgrounds is confirmed, e.g. the role 'EV- Manufacturer' (D) is only occupied by companies from the automotive industry.

The VDAM frame of reference and the positioning of companies allows deriving relevant information about the domain. Based on the VDAM approach, transparency about the engagement of enterprises in the domain can be reached, which can be of high value concerning the decision on if and how to implement a business model in the domain, beginning with the decision which roles to assume and what strategic partners to acquire.

5.2.4 Combination of analysis results for an informed decision on a business model

Analysis based on the frame of reference can lead to new insights about a domain (see Chapter 5.2.1, 5.2.2, and 5.2.3). These insights can be combined to create a deepened knowledge about the value creation and delivery within a domain and can support a more informed decision on a business model, e.g. the optimal positioning within the value network (see Chapters 4.5 and 4.6). The business model described by expert B1 is an example which allows displaying how information derived from the VDAM framework can influence business model decisions on a strategic level. Firstly, as shown in Figure 50, the VDAM frame of reference allows displaying the positioning of the company within the value network. This transparency on its own is already valuable insight and knowledge. Even more so, this positioning combined with the knowledge gathered via the different types of analysis arises several questions which might be worth considering (see Figure 55).

Company 1 originates in the automotive industry and occupies, as displayed in Figure 55, all roles with a direct connection to the end-customer role 'EV- User' (C). At least amongst the companies in analysis, it is the only company offering such a holistic set of value propositions towards the end- customer. While this can be considered a position of strength, some other aspects of the companies positioning and its choice of strategic partners might be taken into consideration.

Looking at the triplet of 'Setup Organizer' (H), 'Investor' (I), and 'Charge Point Operator' (J), company 1 does not occupy the latter but considers companies that are assuming it as strategic partners. The analysis of the roles in the value network shows (see Chapter 5.2.1), that the role 'CPO' (J) is a role with strategic

influence in the domain, because it acts as a hub, structuring and coordinating the value propositions of several other roles. Additionally, it offers an important value proposition to the role 'Investor' (I). Adding the findings concerning the role occupation (see Chapter 5.2.2), it becomes apparent that company 1 is the only company that does take on the role 'Setup Organizer' (H) but not the role 'Charge Point Operator' (J). On the other hand, the roles 'Setup Organizer' (H) and 'Charge Point Operator' (J) are mostly occupied by companies with a background from energy and not by corporations with an automotive background (see Chapter 5.2.3).

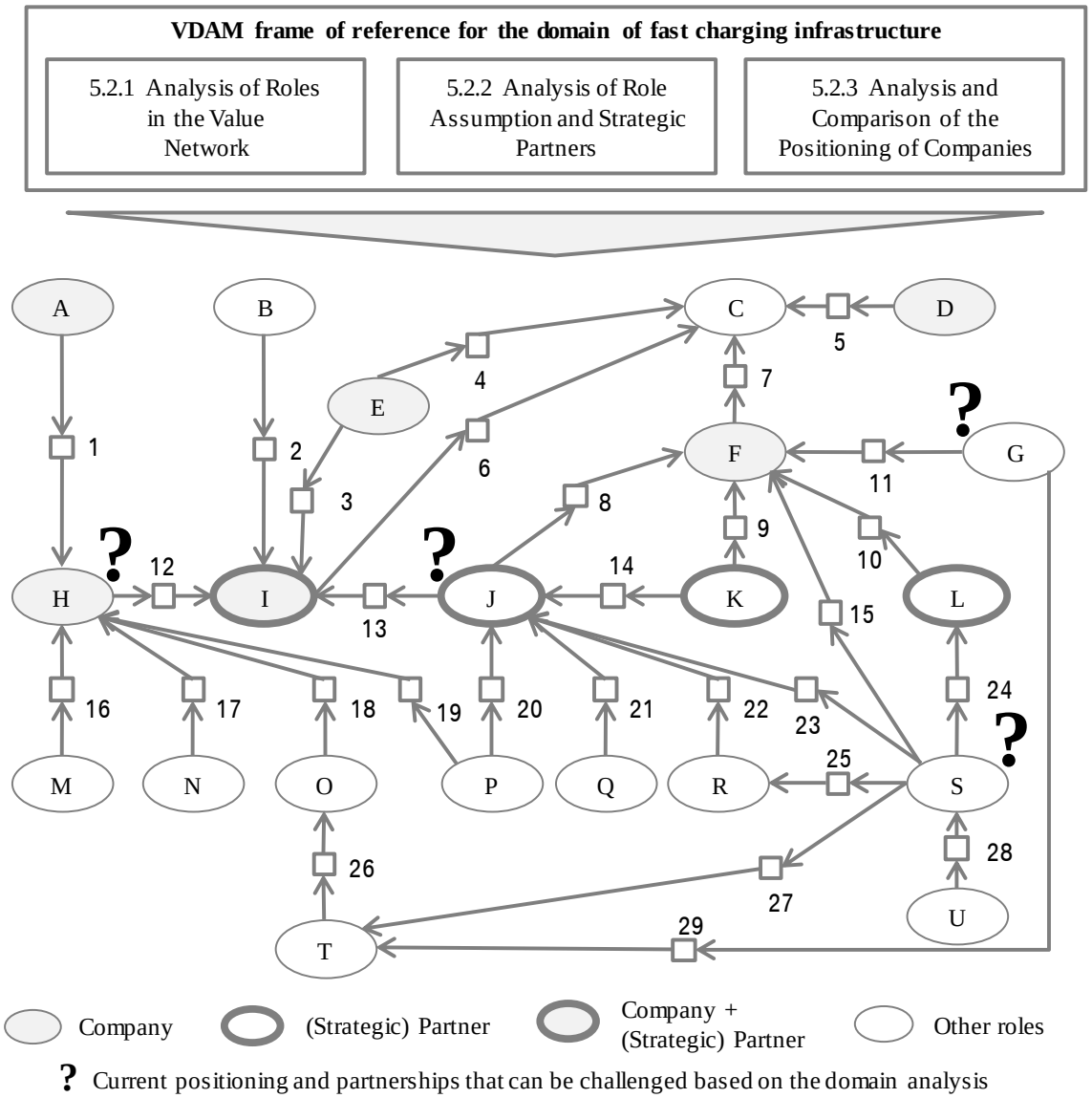


Figure 55 - Analysis results challenge the company's positioning and its strategic partnerships

In conclusion, the question arises if maybe the role 'Charge Point Operator' (J) might be assumed by expert B1's company to occupy this strategic role and build a counterweight to the enterprises of the energy

sector. Alternatively, it might be reasonable to consider to stop taking on the role as 'Setup Organizer' (H). Organizing the installation of charging stations is not a standard competency of companies from the automotive industry. Additionally, it is difficult to see why companies acting in the role of 'Investor' (I) should hire an automotive company to organize the installation without conducting the subsequent operations.

Looking at the role 'Access Technology Provider' (G), the analysis of roles in general (see Chapter 5.2.1) shows, that this role is necessary for the authentication process for the value proposition 'Customer-friendly Access to CS' (7) offered by the role 'EMP' (F). The analysis on role assumption and partnerships (see Chapter 5.2.2) reveals that all but one company that are occupying the role 'EMP' (F) are taking on the role 'Access Technology Provider' (G) as well, or at least consider the role important enough to have a strategic partnership. As the comparison of the positioning of companies reveals (see Chapter 5.2.3) mostly companies with an energy background are assuming this role, but one automotive company and one company with a service background are active in this role. Combining this information derived from different types of analysis, it seems reasonable to consider to assume this role or build a strategic partnership with a company active in this role.

As revealed by the analysis of the roles in this new domain (see Chapter 5.2.1), the role 'Roaming Platform' (S) has a special significance in the value network by offering value propositions to five different roles. Important to notice is the fact that the role offers economies of scale to two of the most important roles in the value network: 'Charge Point Operator' (J) and 'EMP' (F). By looking at the role assumption and strategic partnerships (see Chapter 5.2.2), it becomes apparent that only a few companies are occupying this role and, so far, it is considered a strategic partner only by one other company. As revealed by the analysis of companies positioning, two of the three companies, assuming this role, are from the service industry and show limited efforts to take on other roles to become a serious competitor to expert B1's company. Taking this information into consideration, it might be of interest to build strategic partnerships with companies assuming this role, especially in the case that the role 'Charge Point Operator' (J) would be taken on.

The analysis and conclusions for expert B1's company are a thought experiment from an outside perspective and many other factors manifest when making a decision on assuming another role in the value network or on building new strategic partnerships. Nonetheless, it is an example of how the frame of reference and the positioning of companies within it can create transparency and valuable information. In sum, the different types of analysis enable to deepen the understanding on several aspects. Besides a clear understanding of the value creation network in the domain of fast charging infrastructure (see Chapter 5.2.1), it is possible to carve out indications about the competitiveness of different roles and the importance of strategic partnerships (see Chapter 5.2.2). By looking at the specific positioning of companies active in

the domain, conclusions towards current and potential future engagement of enterprises from certain industries can be drawn (see Chapter 5.2.3). All of these analyses support the decision-making process of innovative enterprises that consider market entry as well as of companies already active in the field (see Chapter 5.2.4).

5.3 (Re-) Designing the value creation network – the validator role case study

As introduced in Chapter 4.5, the VDAM approach can be used to assess potential changes in the value network based on a business model idea as well. For the domain of installation and operation of fast charging infrastructure in Germany, a workshop series with experts from an automotive company was conducted to instantiate the process and assess its applicability. Therefore, based on a particular issue in the domain which has been known to the experts, the potential of a change in the value creation was assessed. Subsequently, the setup of the workshop and the background to the case study will be displayed (see Chapter 5.3.1). Presenting the results of the workshop concerning a redesigned value network based on the findings follows next (see Chapter 5.3.2). This case study concludes with examples of more detailed VDAM views, introduced in Chapter 5.3.3.

5.3.1 Setup and background of the case study

Two workshops with four experts from engineering and business development of an automotive company are conducted. This company assumes, amongst others, the roles ‘EMP’ (F) and ‘EV-Manufacturer’ (D). The experts have all been working for two or more years in the domain of public charging including fast charging and are not part of the initial study (see Chapter 3). Out of the perspective of social sciences, they represent a homogeneous, real group because they are colleagues, working together in this field of fast charging infrastructure (Schirmer, 2009). According to Bortz & Döring (2013) homogeneity as well as only a small difference in social status, hierarchy, and educational background is vital for success.

The topic under research is based on a real-world problem that companies acting as ‘EMP’ (F) or ‘EV-Manufacturer’ (D) are facing: sometimes data about charging stations is outdated and sometimes it is simply wrong. Examples of characteristic problems are:

- Charging stations have been demolished and therefore do not exist anymore.
- Charging stations have opening hours, and these opening hours are communicated falsely or are not communicated at all to companies taking on the ‘EMP’ (F) role.
- The data set for charging stations contains incorrect or imprecise information about the geo-position of a charging station.

- Charging stations are, despite different information, not accessible to the public.

These topics might be interpreted as minor inconveniences. According to the experts, they can have major effects on actors assuming the role 'EV- User' (C): Fast charging stations are much less visible than fuel stations, due to their much smaller size and the fact that, unlike at fuel stations there is mostly just one or two fast chargers next to each other. Additionally, because of the limited availability of fast charging stations (see Chapter 3.1 or (Nationale Plattform Elektromobilität, 2014)), not finding a charging station or not being able to access it due to limited opening hours can cause breakdowns. These breakdowns decrease customer satisfaction, can cause cost for the 'EMP' and 'EV-Manufacturer', and can make electric mobility, in general, appear in a bad light. Therefore, according to the experts, validation and continuous re-validation of charging station content are important for the value network as a whole.

The case study, being a part of the instantiation of the VDAM framework, is structured as follows: After an initial definition of the problem, the experts use the frame of reference of the domain (see Figure 49) to describe the status quo and to allocate which role is currently conducting this validation and re-validation of charging station content. Afterward, different scenarios to re-allocate these efforts are discussed, including potential value propositions that might be offered. As part of this step, the experts visualize their ideas in the frame of reference.

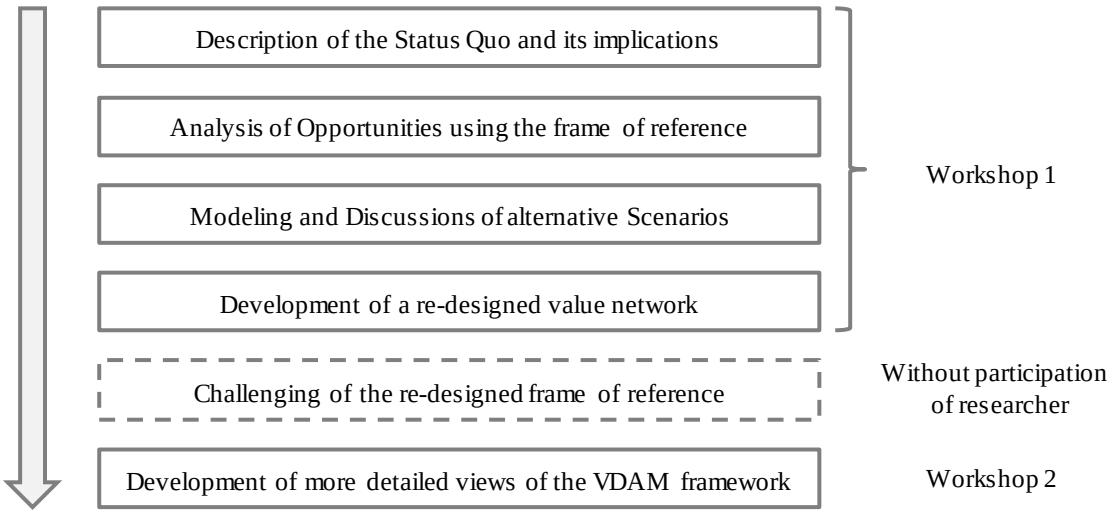


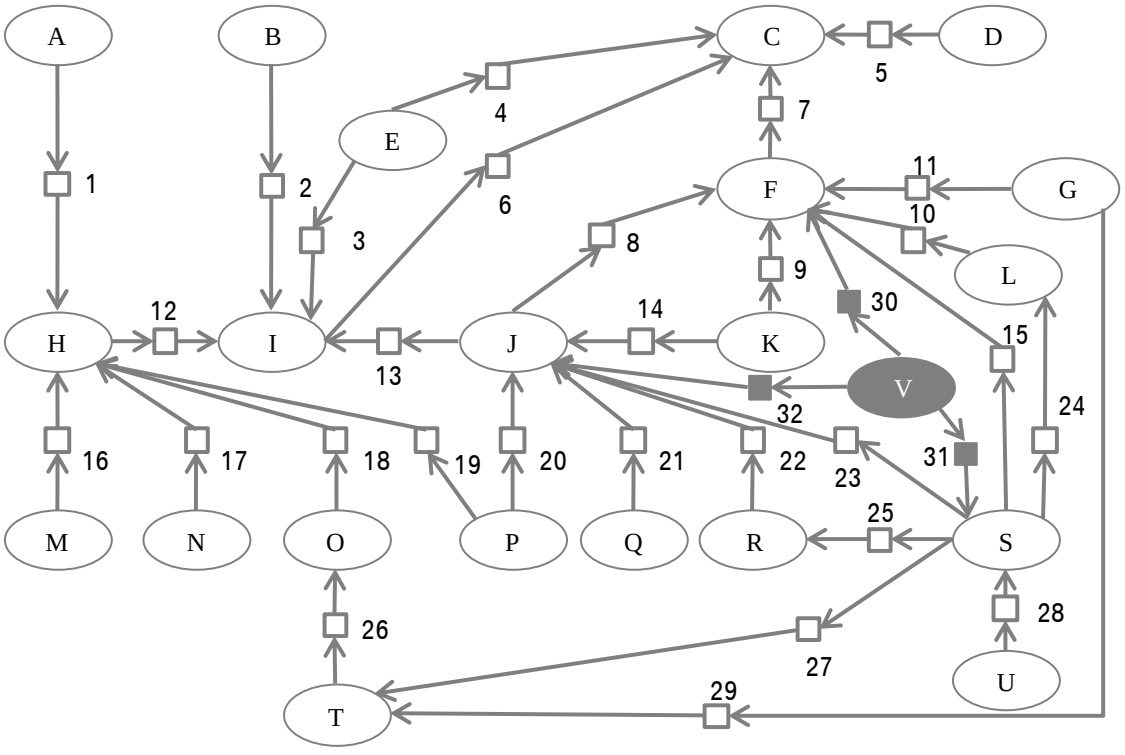
Figure 56 - Process of the 'Charging Station Validator' case study

According to the experts, the resulting shared view on the redesigned value network for the domain is challenged with some other colleagues without the author present. Within the second workshop, underlying views are generated to deepen the understanding of the new role and its effects on the value network. This case study is set up as an open group discussion. This method is focusing on the self-dynamic of the participants while the researcher stays in the background, observing and only engaging if asked to or if the discussion is ceasing (Bortz & Döring, 2013; Schirmer, 2009).

The following subchapters display some results of the discussions, leading to a redesigned value network (see Chapter 5.3.2) and examples of more detailed views on the topic that can facilitate a potential subsequent operationalization (see Chapter 5.3.3). Due to the sensitivity of the subject of new business model ideas, explicit transcripts of the discussions during the workshops are not generated. Instead, the moderation method was applied in which the participants develop a structured, consensual result (Bortz & Döring, 2013; Klebert, Schrader, & Straub, 1984). The following subchapters will display some simplified results of the discussion and modeling of different VDAM views.

5.3.2 Redesigning the value network

As stated above (see Chapter 5.3.1), a workshop with four experts from engineering and business development is conducted concerning the topic of content quality and ways to potentially improve it. The resulting redesigned Value Proposition Exchange Diagram representing the value network of the domain includes one new role: 'Charging Station Validator' (see Figure 57).



New Role
v) Charging Station Validator

New Value Propositions
30) High Quality Charging Station Content
31) Content Quality Assessment
32) Declaration of Charging Station Correctness

Figure 57 - Redesigned value network including the new role 'Charging Station Validator'

The initial discussion reveals that, from the experts' perspectives, their company conducts the task of re-validating the content while assuming the role 'EMP' (F). From their perspective, this is not only inefficient because the company has only limited opportunities to correct the content, but it has the effect, that they perform a task that is beneficial for all enterprises occupying the role 'EMP' (F). Therefore, their efforts lead not only to costs for their company but it benefits the industry as a whole and therefore their competition as well. Due to these facts, in their opinion, a new role 'Charging Station Validator' (V) needs to be included in the value network of the domain. This role offers a value proposition 'High Content Quality of Charging Station Content' (30) to all companies acting as an 'EMP' (F). Additionally, this role can offer the value proposition 'Assessed Content Quality' (31) to 'Roaming Platform' (S).

Table 11 - Ontology Element for the role 'Charging Station Validator'

Name of Role	**Charging Station Validator**
Description	Role (V) is validating and re-validating the charging station content via Geo-referencing, on-site testing and further methods to confirm the correctness of the content provided by 'Charge Point Operator' (J) to 'EMP' (F) via 'Roaming Platform' (S)
Example	Company C takes on the Charging Station Validator Role for BMW-owned charging stations on semi-public BMW property, e.g. dealerships. Thereby C tests the correctness of the geo-location, opening-hours and accessibility.
Actor	Automotive, Service Industry
Target Role	false
Received Value Proposition from Offering Role	-
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ HIGH CONTENT QUALITY FOR CHARGING STATIONS (30) to ELECTRIC MOBILITY PROVIDER (F) ▪ ASSESSED CONTENT QUALITY (31) to ROAMING PLATFORM (S) ▪ DECLARATION OF CHARGING STATION CONTENT CORRECTNESS (32) to CHARGE POINT OPERATOR
Expected Value to Target Role	VALUES

This value proposition can be used to convince companies assuming the role 'EMP' (F) to connect to the platform because of the high content quality. Additionally, the assessment can help a company acting as a 'Roaming Platform' (S) to determine the companies that should increase their content quality when taking on the 'CPO' role (J). The third value proposition offered by the 'Charging Station Validator' (V) is a 'Declaration of Charging Station Content Correctness' (32) to the role 'CPO' (J). A confirmation of content correctness can be used to convince companies assuming the role 'EMP' (F) to include the operator's

network into their offer to the ‘EV- User’ (C), thereby increasing the potential for charging events at its charging stations.

In addition to visualizing the new role and its value proposition in the Value Proposition Exchange Diagram, this role and the corresponding value propositions are described in the semi-formal ontology (see Table 11).

5.3.3 Deepening the understanding and furthering a potential operationalization

Besides modeling the overall value creation in a domain just as fast charging infrastructure (see Chapter 5.1), the VDAM framework can be used to visualize, analyze and understand key aspects in more detail, thereby supporting the subsequent operationalization of a business model idea (see Chapter 4.6). Following, three examples of these more detailed views for the domain of fast charging infrastructure will be introduced. First, the process of validation and re-validation of charging station content along the roles is displayed in an Activity Network Diagram. This is followed by the display of a subset of necessary capabilities to perform the role of a ‘Charging Station Validator’ (V). Finally, an application of a Measurement Dependency Graph is introduced which displays the relationships between different aspects of charging station validation. Additionally, examples of selected semi-formal ontology elements will be presented.

The process of validation and re-validation of charging stations includes two roles: ‘Charge Point Operator’ (J) and ‘Charging Station Validator’ (V). As Figure 58 displays, the process starts with the inclusion of a new charging station in the database by the ‘Charge Point Operator’ (J), adding value by increasing the database. This data is transferred to the validator role for testing. Following, the ‘Charging Station Validator’ (V) applies methods to confirm or refute the correctness of the content. In the case of rejection, this information is communicated to the operator again. The operator needs to make changes, according to the problem report and can re-transfer the corrected content to the validator role. Then the dataset gets tested again. If the content is confirmed, the corresponding dataset gets transferred to a database that includes confirmed charging stations only. From this database, the content then gets transferred back to the role ‘Charge Point Operator’ (J) including the declaration of correctness for this charging station. Regularly, the charging station content needs re-validation. If the content is still correct, no further action needs to be initiated. In case the information is not accurate anymore, e.g. because of changed opening hours, the outdated content gets submitted to the operator and needs to be adjusted. After correcting the dataset, the validation of the content will be conducted anew. The last step of the process is the transfer of the confirmed dataset back to the ‘Charge Point Operator’ (J). The confirmation adds value in the process because it allows the operator to adjust its database by adding the attribute validated = true. This signals that the content correctness is confirmed by an independent third party.

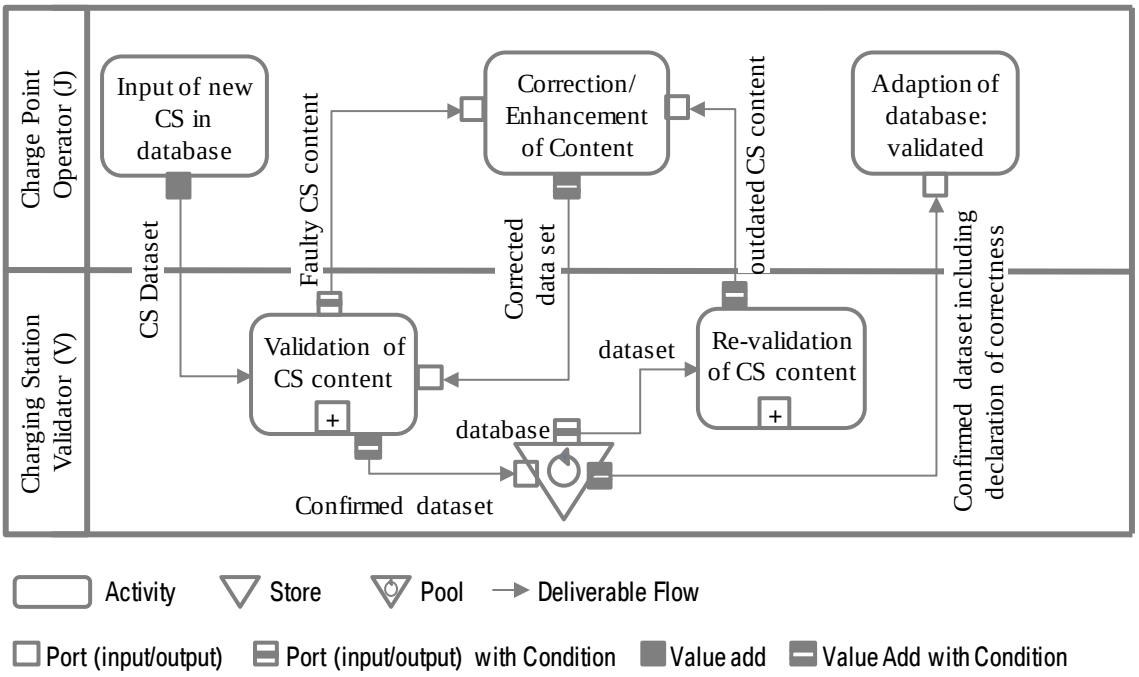


Figure 58 - Activity Network Diagram of the CS content validation and re-validation process

As the example shows, this type of diagram allows deepening the understanding of processes and tasks involved to generate value (see Figure 58). Nonetheless, not every detail needs to be displayed and the level of abstraction is the responsibility of the model designer. As indicated by the '+' symbol within the activities 'Validation of CS content' and 'Re-validation of CS content' these activities have been modeled in more detail, including the actual methods applicable to test the charging station content. Nonetheless, a shared understanding amongst the stakeholders can be generated and necessary steps of the process for a potential subsequent operationalization can be deduced.

Figure 59 represents an excerpt from the actual modeling of larger Capability Management Diagram, developed by the experts. The organizational unit 'Charging Station Validator' (V) has two capability offers, namely 'Geo-Referencing' and 'On-site validation'. 'Geo-referencing' represents the ability to map the geo-location of a charging station with the geo-location of the corresponding address of the charging station. 'On-site validation' means the physical confirmation of attributes at the location of the charging station. While, according to the experts, the associated capability method of the 'Geo-Referencing' capability offer is performed by the operator role itself, the on-site validation capability method is dependent on capability offers from the role 'On-site tester'. This organizational unit is not represented in the value network due to the experts' opinion that it adds unnecessary complexity and detail to this more strategic view on value creation and delivery. Therefore, it can be subsumed within the 'Charging Station Validator' role (V). On this more detailed level, on the other hand, the model designers use this additional organizational unit to signal that the corresponding capabilities, resources, and underlying activities don't necessarily need to be

performed by the validator role itself but might be outsourced. The capability methods within this type of diagram represent activities, resources, business items and other requirements necessary to deliver the corresponding capability offer. In the case of 'Geo-referencing', examples are the activity 'Mapping of addresses to geo-locations' or the resources 'IT-staff' and 'Server Infrastructure'. The capability method 'On-Site Validation' includes, for example, an activity 'planning the test route'. This view does not display this activity. Nonetheless, as stated above, this capability method depends on two other capability offers 'Fleet' and 'Test- drivers', provided by the organizational unit 'On-site tester'. This organizational unit needs, amongst other things, EVs and staff to deliver this capability offer.

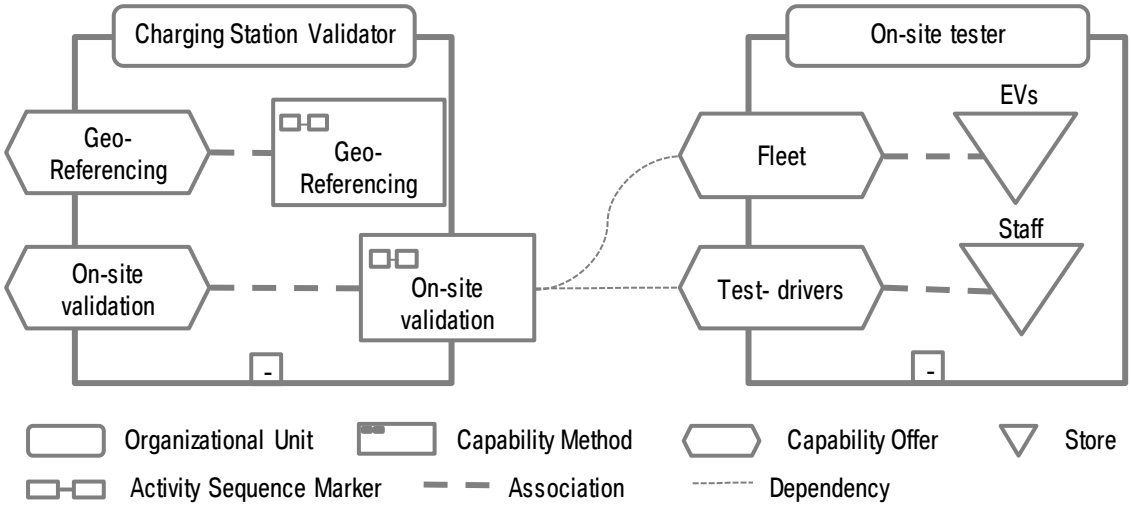


Figure 59 - Capability Management Diagram of the 'Charging Station Validator' role

As this example shows, the Capability Management Diagram can be used to identify in more detail, what capabilities are necessary to offer a value proposition. Additionally, the model designer is encouraged to determine the appropriate activities, resources or other requirements. Based on the diagram or while modeling, gap analysis between required and existing capabilities can be conducted and decisions on make-or-buy can be facilitated. Additionally, depending on the level of granularity, this type of diagram can be used as input for the design of the companies' organizational structure when operationalizing a business model idea.

An extract of the Measurement Dependency Graph for the topic of charging station validation and re-validation is displayed in Figure 60. The experts assume, that an initial validation of a charging station content will increase the content correctness in the databases, especially attributes such as geo-coordinates, opening hours and accessibility. From their perspective, the correct content will increase the number of successful charging events at a charging station. Successful charging events subsequently increase customer satisfaction and the usage of a charging station. Re-validation, according to the experts, increases content correctness as well and has the same implications as the initial validation, finally leading

to an increased usage of a charging station. Interestingly, the experts fear that an increased usage will have a negative influence on re-validation. While it could be assumed that the lesson learned of an enhanced content quality would be to invest further in the content correctness, expert agree that it would, most likely, decrease the efforts on content re-validation. Their reasoning is mostly based on cost. Initial validation and re-validation will both increase cost. And the cost will have a negative influence on both activities. Therefore, if a charging station is being used more often by EV- Users, this will incline companies to reduce costs by reducing re-validation. According to the experts, this is a risky and maybe even short-sighted approach. To strengthen the reasoning, one expert describes the following situation: A charging station on the parking lot of a supermarket is only accessible during the opening hours of the supermarket. Due to some reason, these opening hours change. While the local EV- Users might be aware of that and adapt their charging habits, EV- Users that are only passing through and want to use the fast charger to reach their actual destination, most likely, won't be aware of the changed opening hours. Therefore, these EV- Users will have a bad charging experience because they drive to a charging station that is supposed to be open but is not. Especially nowadays, where the number of fast charging stations is low, this can cause serious problems for the users of EVs.

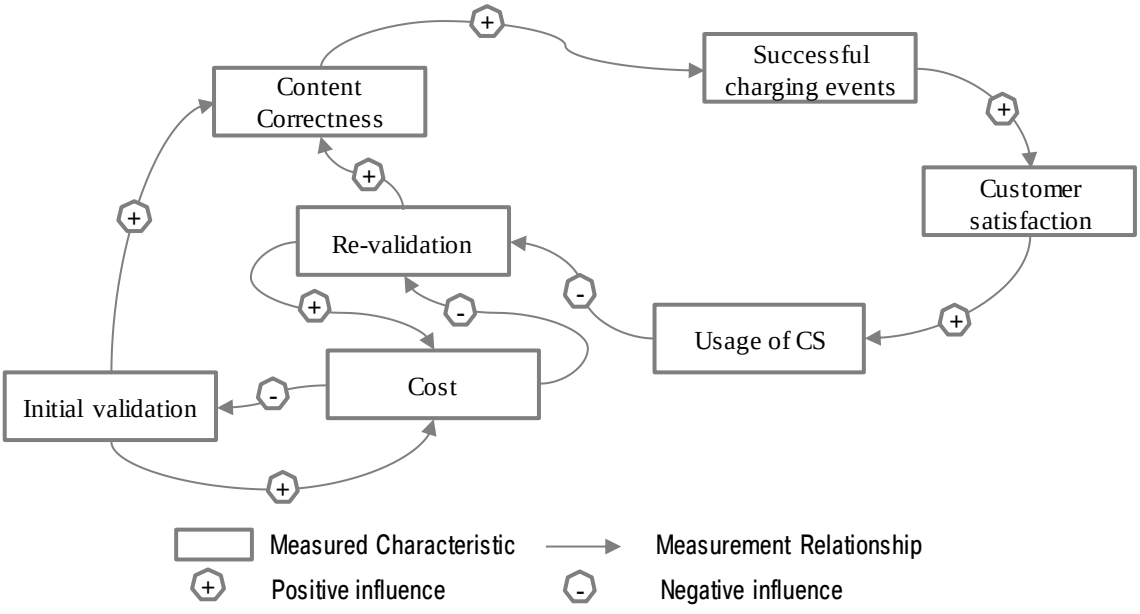


Figure 60 - Measurement Dependency Graph for the topic charging station validation

The discussion about this topic revealed a dependency that is not necessarily intuitive but might have significant implications for the roles 'EMP' (F) and 'EV- Manufacturer' (D). The experts agree that provisions should be developed to lower the risk, that cost and the increased usage of charging stations will reduce the level of re-validation and therefore reduce the level of content quality. One of the ideas is, that not only the role 'CPO' (J) should cover the cost of validation and re-validation but that other roles within the value

network of the domain can support the efforts. The displayed example of a Measurement Dependency Graph shows, how this type of diagram can be used to show the logic of value creation and helps to distinguish critical relationships between different aspects, thereby facilitating an informed decision on how to implement a business model idea.

The more detailed views of the VDAM tool can create a more in-depth understanding of processes, necessary capabilities, required resources, and dependencies between different aspects of the value creation. As the example of the topic validation and re-validation of charging station content reveals, the different types of views and diagrams support shedding light on various aspects. The Activity Network Diagram helps to display and understand key processes of value creation. The Capability Management Diagram reveals the necessary capabilities to offer a value proposition, contributes to decide on make-or-buy-decisions and can support the design of organizational structures. The Measurement Dependency Graph, on the other hand, can be used to identify interdependencies of aspects of the value creation process, which might stay unnoticed otherwise. All of this leads to a more informed decision on if and how to implement a business model idea.

5.4 Conclusion

Chapter 5 displays the instantiation of the developed Value Delivery Architecture Modeling approach, introduced in Chapter 4. As stated in Chapter 4.6, VDAM is developed to address some undervalued aspects of business modeling, namely embeddedness in the supply network (Song et al., 2008), the creation of a common understanding amongst stakeholders, and supporting the subsequent operationalization of business model ideas. In other, more general terms, VDAM is supposed to make a contribution towards a more informed decision in critical questions of entrepreneurial management. The case of fast charging infrastructure in Germany was chosen as an instantiation, due to its potential importance in the years to come and its complex and uncertain environment not favorable to direct investments and entrepreneurial engagement. The case of fast charging infrastructure in Germany covers the following topics of the Value Delivery Architecture Modeling framework:

- The development of the Value Proposition Exchange Diagram as a frame of reference and the positioning of companies within to create a common understanding amongst stakeholders and enable the subsequent comparison of business models (see Chapter 5.1).
- The analysis of the value creation network, competitiveness of roles, and business models of companies to learn about and understand the new domain based on the embeddedness in the supply chain (See Chapters 5.2.1, 5.2.2, and 5.2.3).
- The learnings about the domain and how the subsequent deepened understanding enables companies or entrepreneurs to question their current business model idea (see Chapter 5.2.4).

- The potential of the Value Delivery Architecture Modeling framework including the frame of reference to facilitate transparency and communication with stakeholders in complex situations (see Chapter 5.3.2 and 5.3.3).
- The capability of the Value Delivery Architecture Modeling framework to question and potentially change the value creation logic in a domain (see Chapter 5.3.2).
- The potential of the VDAM approach to deepen the understanding and further the subsequent operationalization by modeling the underlying views Activity Network Diagram, Capability Management Diagram, and Measurement Dependency Graphs (See Chapter 5.3.3).

As the exploratory study in the domain of fast charging infrastructure shows, the perspective on the value creation and delivery are highly diverse amongst experts (see Chapter 3.5). This, sometimes fundamentally, different understanding can be a hindrance for collaborative, cross-industry business models. The Value Proposition Exchange Diagram as part of the VDAM approach addresses this issue. By incorporating and subsequently normalizing the different views of the experts, a comprehensive frame of reference with 21 roles and 29 value propositions is created (see Chapter 5.1.1). The fact that all business models described by the experts can be positioned in this frame of reference (see Chapter 5.1.2) shows the unifying character of the frame of reference. This unification combined with the explicit description of roles and value propositions in an semi-formal ontology enables a shared understanding of the value network of this new domain amongst stakeholders. Furthermore, the frame of reference is the basis for transparency and comparability of business models in this new domain (see Figure 61).

The frame of reference for value creation and the positioning of companies within enables entrepreneurs and BMI teams to analyze the situation in more detail. As shown in Chapter 5.2.1, the frame of reference itself can already be used to create a more in-depth understanding of the value creation. Understanding the importance of different kind of roles in the value network can be of value to people responsible for the business model, e.g. knowledge that the roles ‘Charge Point Operator’ (J) and ‘Setup Organizer’ (H) are offering a comprehensive value proposition to the role ‘Investor’ (I). Additional information about the type of business that roles are active in can be meaningful as well, e.g. knowledge that only four roles active in the B2C business. Looking at the role assumption of companies, interesting facts about competitiveness and characteristic combinations of roles can be derived (see Chapter 5.2.2). This analysis would not have been possible without creating this unifying frame of reference as part of the VDAM approach (see Figure 61). In the case of fast charging infrastructure, it is interesting to notice that the role most occupied is ‘Charging Station Seller’ (O). Another finding is, that if a company assumes the role ‘Charge Point Operator’ (J), it almost always takes on the role ‘Setup Organizer’ (H) as well, offering a holistic set of value propositions to the role ‘Investor’ (I). Besides findings of role assumption, insights about partnerships can be derived as well, e.g. that the role ‘Access Technology Provider’ (G) is of great importance to many companies and ‘Public Authorities’ (M) and ‘Government’ (B) are not. Further analysis on the topic reveals

interesting facts about role assumption of companies. Taking the industry background into consideration, the positioning of enterprises in the frame of reference shows that the engagement varies considerably. While enterprises of the manufacturing sector tend to focus on their core competencies, companies with an energy background try to position themselves as suppliers to the 'Investor' role (I). Some enterprises of the automotive and service industry try to break this dominance but are not that engaged in this topic. Two companies from the automotive industry do not even take on a single role in the new domain, yet. On the other hand, the other automotive companies compete with enterprises of the energy sector to position the roles with direct value propositions to the end-customer role 'EV- User' (C).

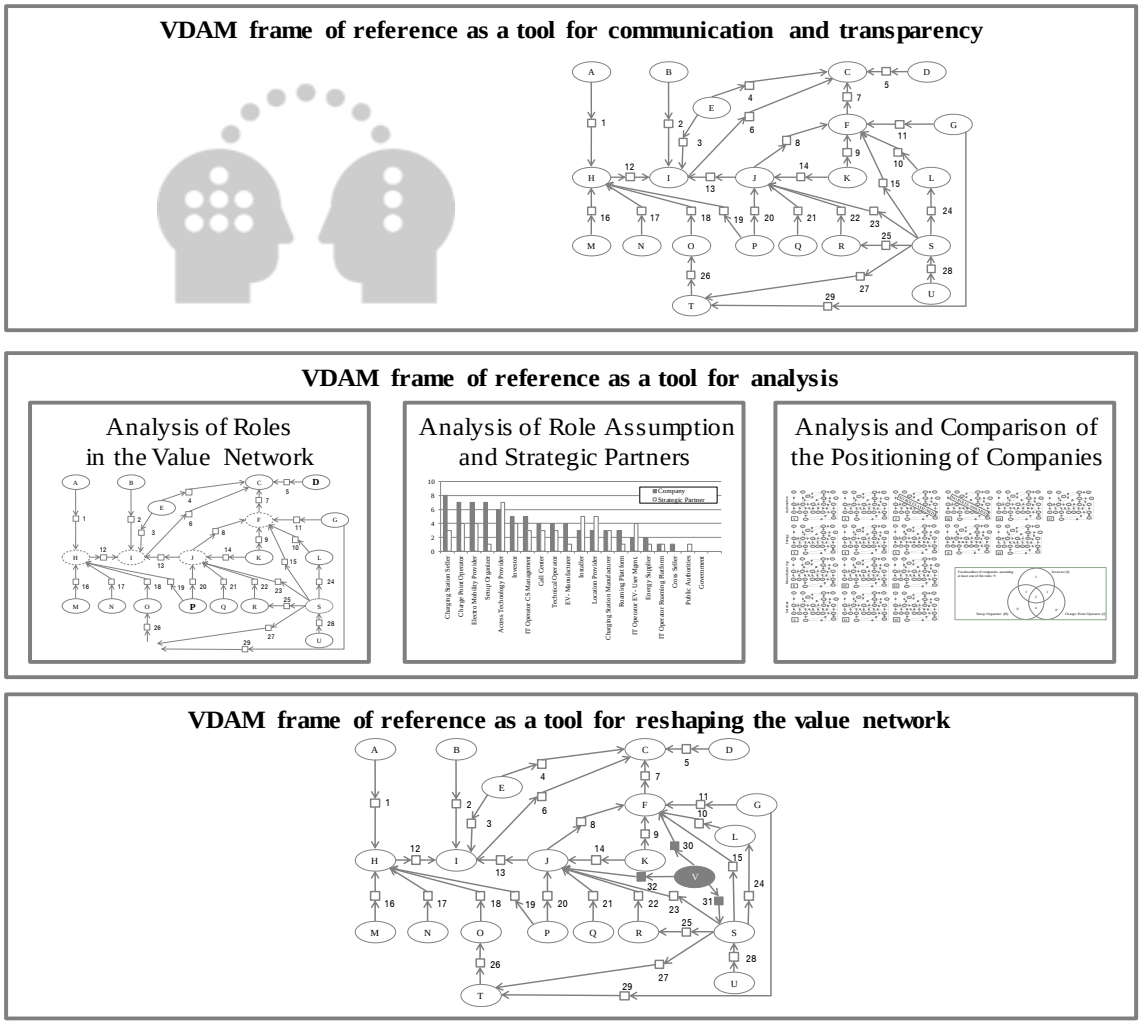


Figure 61 - Contribution of the VDAM frame of reference

These examples of different types of analysis based on the frame of reference and the positioning of companies within have value on their own, creating transparency and insights, which would not have been possible without the VDAM approach. As shown in Chapter 5.2.4, the combination of these individual findings creates additional value and enables entrepreneurs and BMI teams to make a more informed

decision on if and how to implement a business model idea. The case of Expert 1's company shows that it might be of interest to consider to assume other roles, e.g. 'Charge Point Operator', to leave some roles behind, e.g. 'Setup Organizer', and to explore new partnerships, e.g. with a company assuming the role 'Roaming Platform'. Without the normalizing aspects of the VDAM frame of reference, a deep analysis of the competitiveness of roles, competitor analysis (Porter, 2008), and clarity about potential coopetition situations (Bengtsson & Kock, 2000) as well as key partnerships (Lindgren & Rasmussen, 2013) would not have been achievable.

While the VDAM approach can be a valuable tool to assess the current business model or the business model idea under consideration, it also allows entrepreneurs and business modeling teams to think about how to redesign the value network (see Figure 61). As shown in Chapter 5.3, the potential of the VDAM approach reaches further than deepening the understanding, increasing transparency, and enabling the assessment of the current business model or the business model under consideration. The approach enables entrepreneurs to analyze business models ideas that change the present value creation network. As shown by the validator role case study (see Chapter 5.3.1), ideas of how to change the status quo can be visualized and discussed, based on the frame of reference (see Chapter 5.3.2). In the validator role case, the experts find out, that the task of validation and re-validation of charging stations can create value propositions to the different roles within the value network. This general understanding of the potential of a new role in the value network is deepened by modeling and thereby analyzing key processes, necessary capabilities and resources, and interdependencies of parts of the value creation process. Thereby, the underlying views of the VDAM approach, namely the Activity Network Diagram, the Capability Management Diagram, and the Measurement Dependency Graph are used. The modeling of these views does not only deepen the understanding of value creation and delivery in this new domain but can support a subsequent operationalization of the business model idea.

The successful instantiation of VDAM in the domain of fast charging infrastructure proves the validity of the artifact and shows how its goals are reached. As stated above, the instantiation demonstrates how this new tool can contribute to business modeling and enables users to a more informed decision on if and how to implement a business model. The VDAM frame of reference based on the VPED unites the experts' differing views on value creation in the domain. The resulting transparency can be used for different types of analysis that support decision making. Furthermore, new ideas on how to redesign the value network can be visualized and analyzed. The subsequently modeled more detail views of the VDAM framework support a deepened understanding of value creation in the domain and facilitate the potential operationalization of business model ideas, as shown in the validator case. Nonetheless, in accordance with design science research, further evaluation of this new approach is deemed of scientific value (Am Worren, Moore, & Elliott, 2002; Hevner et al., 2004; S. T. March & Smith, 1995; Van Aken, 2004) and will be introduced in the subsequent Chapter 6.

6 Evaluation of Value Delivery Architecture Modeling

Evaluation as part of design science research projects is highly relevant to close the so-called relevance gap and needs to be conducted with the corresponding rigor (Am Worren et al., 2002; Hevner et al., 2004; S. T. March & Smith, 1995; Van Aken, 2004). According to Am Warren et al., 2002, two kinds of validity can be distinguished for design science research: scientific validity and pragmatic validity. Scientific validity asks for the development of explicit and propositional knowledge that, amongst other things, needs to be explanatory and falsifiable. Nevertheless, scientific validity does not ensure usefulness for practitioners that are faced with particular challenges such as time pressure, uncertainty, and complexity of real life. Pragmatic validity is intended to ensure the practical usefulness of artifacts generated by research. Therefore, focus lies on the extent to which goals or intended consequences of an artifact can be achieved, e.g. by assessing the level of adaption of an artifact, applying experimental methodologies, or conducting user surveys (Am Worren et al., 2002). The need for pragmatic validity holds true for the present work, due to its allocation in management theory (see Chapter 1.3). Management theory, in contrast to organization theory, is prescription driven, leading to the development of abstract knowledge to solve a class of managerial problems (Van Aken, 2004). Subsequently, the evaluation methods applied in the present work are introduced (see Chapter 6.1). This is followed by the evaluation results for the instantiation of the VDAM framework in the domain of fast charging infrastructure in Germany (see Chapter 6.2). Subsequently, additional efforts for evaluating the application of the framework in other domains are displayed (see Chapter 6.3). Finally, the concluding results of the evaluation efforts are discussed (see Chapter 6.4).

6.1 Evaluation methods

To guide the evaluation of Design Science Research, Venable et al. (2012) introduced a four-step method to enable researchers to choose appropriate evaluation methods. The first step of this method is to determine the context of the evaluation by assessing six categories. The prioritization of these factors to allow the selection of an appropriate evaluation strategy follows next (step 2) including the corresponding evaluation methods (step 3). This is followed by the detailed design of the evaluation (step 4) (Venable et al., 2012).

This research project on a new approach to business modeling that I call VDAM applies this four-step method by Venable et al. (2012). For the present work, the key evaluand is the instantiation of the VDAM framework in the domain of fast charging infrastructure in Germany. Additionally, the potential for application of this approach in other domains is worthwhile to evaluate. The nature of these evaluands

differ. While the instantiation of the approach is a product, the approach is a process. Both have in common that they are sociotechnical artifacts, meaning that they need interaction with humans to be evaluated. The properties under evaluation need to be the utility, effectiveness and in the case of the instantiation, the similarity of the model to the real world. The goal of the evaluation of the two artifacts is to determine if the developed instantiation in the electric mobility domain is of value to the domain and if the VDAM approach can be of value to other domains, as well. As displayed in Chapter 5, applying the VDAM approach to the field of fast charging infrastructure is feasible, and therefore the artifact is scientifically viable. The subsequent evaluation of this instantiation aims at determining if the resulting views can be considered of value for companies in the domain, to conclude further if the approach can be of pragmatic validity (Am Worren et al., 2002). Furthermore, the evaluation aims at determining if the approach has the potential to be of relevance in other domains as well.

Crucial constraints for the evaluation are time and people. As is the case with any DSR artifact, VDAM and its instantiation need to be applied and evaluated by experts (Van Aken, 2004). Experts for the domain of fast charging people are still rare because it is such a new domain (see Chapter 3.2). And time is a constraint because the experts from the electric mobility domain are currently highly occupied. Electric mobility is one of the key challenges for many of the industries involved in this new field, especially automotive and energy. Hence, the evaluation of the instantiation is time-sensitive and needs the expertise of a limited group of people. Concerning the evaluation of VDAM applicability in other domains, time is a crucial factor, as well. Lessons learned from the instantiation conducted within the research project is, that applying the VDAM approach needs a considerable amount of time to do the domain analysis and the iterative modeling and ontology building to create the frame of reference. Additionally, access to people with interest in the new approach is a potentially limiting factor as well.

Taking all these factors into account, some compromise for the evaluation is required. The general validity of the approach and the corresponding goals is proven already by instantiating the VDAM approach in the domain of fast charging infrastructure in Germany (see Chapter 0). Within VDAM, the Value Proposition Exchange Diagram of a domain is the key view because it is

- creating transparency about the value creation and exchange,
- improving communication between stakeholders,
- constituting the basis for different types of analyses, and
- enabling the redesign of the value network of a domain.

Thus, this view is in the focus of the subsequent evaluation. This limitation needs to be made, mainly to the restrictions on time and availability of people who are capable of conducting the evaluation.

Mapping this context to the DSR Evaluation Strategy Selection Framework by Venable et al. (2012) leads to the result that a naturalistic ex post evaluation strategy is suitable for this research project. The selection framework consists of two by two matrix, composed of the categories ex ante, ex post, naturalistic and artificial. The time dimension of this matrix is divided into ex ante, meaning an evaluation before an implementation of a new artifact and ex post, referring to an evaluation after its implementation. The second dimension can be considered an environmental dimension concerned with the issue if the evaluation is conducted in the real world (naturalistic) or a fabricated (artificial) environment. In the case of this research project, an ex post evaluation is suitable because it allows a summative evaluation of the instantiation and the process itself. A naturalistic evaluation is considered most appropriate because it is more feasible to conduct an evaluation of a sociotechnical artifact by including many diverse stakeholders. This naturalistic ex post strategy is characterized by using real users, reals problems, and real systems for the evaluation. While creating the highest cost of all strategies and involving the greatest risk for the participants because it is conducted in real systems, this evaluation strategy constitutes the best evaluation of effectiveness. Thereby, effectiveness means meeting the higher goal or purpose of the artifact and its achievement of benefits in practice (Venable et al., 2012).

DSR Evaluation Method Selection Framework	**Ex ante**	**Ex post**
Naturalistic	• Action Research • Focus Group	• Action Research • ***Case Study*** • Participant Observation • Ethnography • Phenomenology • ***Survey (qualitative or quantitative)***
Artificial	• Mathematical or logical proof • Criteria- based evaluation • Lab experiment • Computer Simulation	• Mathematical or logical proof • Lab Experiment • Role Playing Simulation • Computer Simulation • Field Experiment

Potential evaluation methods ***Applied evaluation methods***

Figure 62 - Applied evaluation methods derived from Venable et al.'s (2012) selection framework

As shown in Figure 62, every quadrant contains several evaluation methods that are most suitable to the particular situation. In light of the present research project, the methods case study and subsequent surveys are applied as part of a naturalistic ex post evaluation strategy. Thereby, the case study is the application of the VDAM framework in the domain of fast charging infrastructure. Subsequently, the experts involved in the initial empiric study about business models in the domain are used to evaluate the resulting VPED (see Chapter 6.2). The evaluation of the usability of the VDAM framework for other domains

with a focus on the Value Proposition Exchange Diagram is conducted with entrepreneurs and company successors as part of a one-day workshop (see Chapter 6.3), including a survey.

As introduced in Chapter 1.3, design science research is concerned with construction and improvement problems and is prescription driven, meaning that it aims at developing scientific knowledge to solve a class of managerial problems. Artifacts as design exemplars can be considered a technological rule, linking an artifact to the desired outcome in a particular domain of application. To test such a rule, especially towards their effectiveness, Aken (2004) suggests alpha and beta testing of the rule. Thereby, alpha testing is conducted by the originator of the artifact in its original context. Beta testing, on the other hand, is carried out by third parties in other contexts than the original one (Van Aken, 2004). Following Van Akens logic of alpha and beta testing of artifacts, the instantiation of VDAM in the domain of fast charging infrastructure in Germany can be considered an alpha test. This is due to the fact, that the researcher applied the approach, based on the results of an explorative study, conducted in the domain. The subsequent survey with the experts is used to evaluate the efforts. The case study and survey with entrepreneurs and company successors of small and medium-sized companies can be considered the first step towards beta testing. The subsequent chapters introduce both evaluations in more detail, and display the results.

6.2 Evaluation of the instantiation in the area of fast charging infrastructure in Germany

The evaluation of the frameworks instantiation in the field of fast charging infrastructure in Germany is focusing on the VPED of this new domain, representing the value creation and delivery logic. This view is selected for evaluation because it is the key model of the VDAM framework. This view aims not only at creating transparency about the overall value creation in a domain, but it can also be used as a tool for communication amongst stakeholders. Furthermore, the view is the basis for several types of analysis, leading to new insights to enable a more informed decision about the positioning of a company in this new domain (see Chapter 5.2). Hence, an evaluation concerning the completeness, consistency, and accuracy of the developed view is deemed most important. These results will show if the VPED of the domain is similar enough to reality to be of value to practitioners of the domain. Furthermore, the results can indicate the effectiveness of the framework towards the goal transparency that is the basis for communication and analysis. Subsequently, the setup of the evaluation (see Chapter 6.2.1), its results (see Chapter 6.2.2), and a discussion of these results (see Chapter 6.2.3) will be displayed.

6.2.1 Setup of the evaluation

As stated above (Chapter 6.1) the limited time of the required domain experts makes it necessary to keep the evaluation as easy and little time consuming as possible. The evaluation is conducted using a

questionnaire (see Figure 63). Besides the questionnaire[4], the participants of this survey receive the VPED of this new domain, which is part of the result of the instantiation of the VDAM approach. The questionnaire itself is structured as follows. For every role and value proposition of the domain, the definition, which is part of the ontology is provided. The evaluators are asked to answer if they agree with the description, agree with the key message of the description, or disagree with the description. Additionally, the evaluators can comment on the description. If the evaluator deems it necessary to add roles to the model of the domain, this can be conducted as well.

Role	Description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	Comment
Investor	Role invests in fast charging infrastructure and thereby covers most of the associated risk. Investor aims at generating a viable business by offering fast-charging towards EV-Users. Investor is, from the EV-user-perspective, responsible for the correct functionality of the fast charging process.				

Value Proposition	Description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	Comment
Installed Infrastructure	Fast charging infrastructure is installed on time including all necessary steps of underground work and electrical connection.				

Figure 63 - Structure of the evaluation questionnaire including illustrating examples

These descriptions, in combination with the model view itself, enable the experts to evaluate the roles and value propositions. The introduction to the questionnaire informs the evaluators about the origin of the model view and the corresponding descriptions as part of the ontology. The following three tasks are given:

- Please read the descriptions and illustrating examples and mark the statements which fit best to your opinion.
- If you have comments, please don't hesitate to fill in the comment section with your suggestions of change.

[4] The full questionnaire is displayed in the Appendix

- If you see other relevant roles, feel free to adapt the frame of reference and add a description to the spreadsheets

Hence, by answering the questionnaire, the experts have the opportunity to critically evaluate the model of value creation and delivery in the domain of fast charging infrastructure.

6.2.2 Results of the evaluation

The evaluation is conducted from December 2015 to January 2016. The questionnaire is send out to all seventeen experts that had been participating in the initial empiric exploratory study (see Chapter 3.2). Even though the experts have two months time to evaluate the 21 roles and 29 value propositions of the VPED of the new domain, only seven experts answer. Three of the responding evaluators are from the manufacturing industry, two from services and one each from automotive and energy.

As stated in Chapter 6.2.1, the evaluators have the opportunity to add or remove roles and value propositions from the model of value creation and exchange for the domain, which is the Value Proposition Exchange Diagram. None of the evaluators takes this opportunity. Looking more closely at the answers concerning the description of roles and value propositions, Figure 64 shows that there is a very high level of agreement.

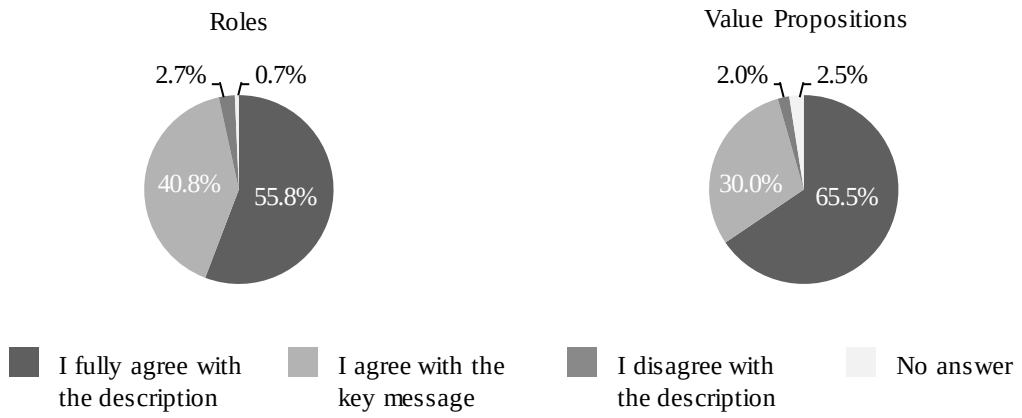


Figure 64 - Overall evaluation results for the roles and value propositions

In almost 56% of the cases, the evaluands fully agree with the description of the role. For another approximately 41% of the cases, the evaluands agree with the key message of the description. Only in less than three percent of the cases, in absolute numbers four times, the evaluators disagree with the descriptions. One time, an expert does not deem herself capable of evaluating a role. Shifting the focus towards the evaluators, three of them fully agree with the description or agree with the key message of the descriptions of all 21 roles. Another three expert have a level of agreement of 95%, disagreeing with only one statement about the roles. The lowest level of agreement with the description is 90%: The

evaluator from the automotive industry disagrees with one description and is not capable of evaluating one role.

Looking at the results of the evaluation of the value proposition descriptions, an even larger percentage of fully agreeing votes is reached. In almost 66% of all cases, the evaluators answer that they fully agree with the description of the value proposition and in another 30% they agree with the key message. In two percent of the cases, in absolute numbers 4 cases, the evaluators disagree with the description. In another 5 cases, the evaluators refrain from answering. Again, shifting the focus towards the evaluators, the distribution differs compared to the role agreement. Five out of seven evaluators fully agree or agree with the key messages of all 29 value propositions. One evaluator from the energy sector does not deem herself capable of evaluating five value propositions, which leads to an overall agreement rate of 83%. One evaluator from the manufacturing industry is more critical, even though her overall approval rate is at 86%: she disagrees with four descriptions of value propositions.

While the results of the overall responses concerning the description of roles and value propositions are of interest, a closer look towards the individual roles and value propositions is of value as well. For sixteen of the twenty-one roles, all evaluators agreed with the key message of the description or fully agreed with the description (see Figure 65). For one role, namely 'Setup Organizer' (H), one expert does not give a clear evaluation but answers with a question mark in the 'agree with the key message of the description column' and does not give any comment on this role. This is not considered an answer to the evaluation of this role description. Besides this invalid answer, four roles did not reach an entirely positive evaluation but had one expert disagree with the key message of the description. These roles are 'Energy Supplier' (P), 'Government' (B), 'Public Authorities' (M), and 'Roaming Platform' (S) (see Figure 49).

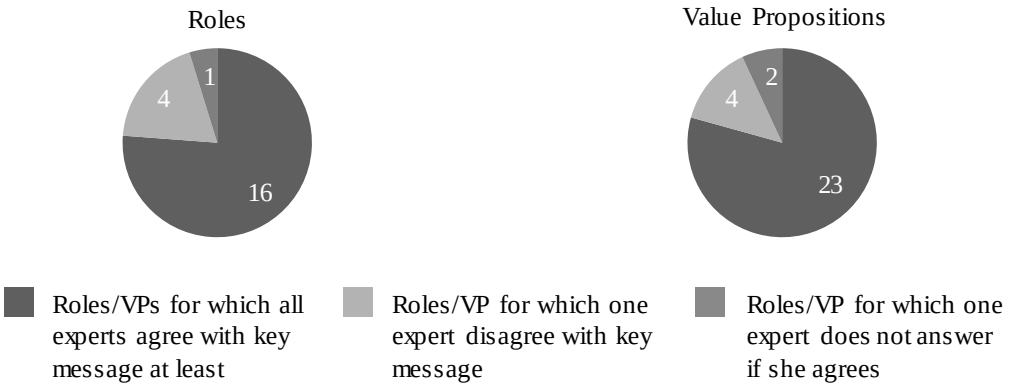


Figure 65 - Level of agreement for the description of roles and value propositions

Looking at the evaluation of the value propositions, all evaluators fully agree or agree with the key message of 23 out of 29 value proposition descriptions (see Figure 65). In two cases, one evaluator does not answer

how she evaluates the description of a value proposition while all other experts agree. For four value propositions, one evaluator disagrees with the description. These value propositions are 'Declaration of Conformity of Chargepoint Management' (25), 'Declaration of Conformity of EV- User Management' (24), 'Declaration of Conformity of fast charging stations' (27), and 'Licenses and Permissions' (16). For the first three of these value propositions, one other expert did not evaluate them, making these to the value propositions with the lowest level of support, because only five of the seven experts agree with the key message of the description or fully agreed with the description.

In most cases, the evaluators comment on the roles (see Table 12) and value propositions (see Table 13) they disagree with. According to the expert from the energy sector, the role that sells energy does not provide the installation at the same time. According to another expert, the role 'Government' (B) does not only provide subsidies but more importantly provides the legal frame for the domain. The expert from the service industry, working for a company that is assuming the role 'Roaming Platform' (S) states that the role does more than described. She argues that providing a legal framework for the B2B business is missing and other services should be added as well. In the case of the disagreement with the role 'Public Authorities' (M), the disagreeing evaluator does not comment on that role, e.g. by providing a better, more accurate description. Concerning the distribution of disagreement on role descriptions, it is worth noticing that the role with a disagreeing evaluation, is criticized by an expert from a different domain.

Table 12 - Role descriptions and comments by disagreeing experts

Role Name	**Description of role with disagreement**	**Summary of the comment by disagreeing Expert**
Energy Supplier	Role provides energy to the fast charging station. Therefore it offers the installation of the initial power supply and also the energy transfer during operations.	• Sales does not organize the power supply installation
Government	Role supports the installation of fast charging infrastructure by offering subsidies to Investor.	• Key task (and key capability): legal frame • Subsidies are not the defining characteristic
Public Authorities	Role offers all necessary Licenses and Permissions to install and operate fast charging stations at (semi) public locations.	• -
Roaming Platform	Role enables EMPs and CPOs to improve their corresponding value propositions by offering a platform to exchange data about charging stations and charging events. Thereby the role sets an operating standard to which charging stations and IT- backends have to comply with.	• Missing: legal framework to ensure B2B • "Operating standard" might be confusing because all platforms have approx. same use-cases • Add "other services" to the definition

Disagreement of value propositions in the domain distributes differently. Only one evaluator disagreed with the descriptions. She is from the manufacturing field. She does not agree with the value proposition 'Licenses and Permissions' (16), stating that there is no need for further licenses and permissions because Germany is already highly regulated. She is the same evaluator who disagrees with the role 'Public Authority' (M), offering this value proposition. Furthermore, she does not agree with three value propositions provided by the role 'Roaming Platform' (S). These value propositions are offering declarations of conformity to other roles. Out of the perspective of this evaluator, there is currently no value add in these value propositions. According to her, that is why they are not necessary.

Overall, the six of the seven evaluators make 89 comments on the different roles and value propositions, 43 on the 21 roles and 46 on the 29 value propositions. The remaining evaluator from the manufacturing domain refrains from any comment. It is interesting to notice that only three elements are not commented on, namely the value propositions 'Power Supply' (19), 'Working Access Technologies for EV- Users' (11), and 'Working Infrastructure for EV- Users' (13). All other roles and value propositions received between one and four comments by the evaluators. Often, these comments are little remarks, additional views, and small aspects of relationships. These are comments are rarely consistent between the different evaluators.

Table 13 - Value Proposition description and comments by disagreeing experts

VP Name	Description of the value proposition with disagreement	Summary of the comment by disagreeing Expert
Declaration of Conformity of Chargepoint Management	A Certificate or seal that shows that a charging station IT system is compatible with the needs of a charging network. This advertises the IT systems compatibility, offers marketing opportunities and sales channels	• No value add
Declaration of Conformity of EV-User Management	A Certificate or seal that shows that a Customer Relationship Management IT system is compatible with the needs of a charging network. This advertises the IT systems compatibility, offers marketing opportunities and sales channels	• No value add
Declaration of Conformity of fast charging stations	A Certificate or seal that shows that a charging station is compatible with the needs of a charging network. This advertises the charging infrastructure's compatibility, offers marketing opportunities and sales channels	• No value add
Licenses and Permissions	all Licenses and Permissions that are necessary for the installation and subsequent operations of a fast charging station	• No additional licenses needed

There is one exception: the description of the role 'Government' (B) is evaluated one time with complete agreement, five times with agreement to the key message, and one time with disagreement to the statement (see Table 12). This role receives four comments, one by an evaluator from every industry participating in the evaluation. Compared to other comments on roles and value propositions, these

comments are very consistent. The original description of the role, derived from the interviews and modeled and included in the ontology, focusses on the fact that the government is subsidizing the installation and operation of fast charging infrastructure in Germany. As the evaluator from the automotive industry states, this is only part of their tasks and in her opinion, not the defining one, because companies and patrons can subsidize the Investor role as well. Instead, it is the core competency of the government to create the legal framework:

'Evaluator from the automotive industry: Die Regierung hat die Aufgabe (und Kernkompetenz) den rechtlichen Rahmen für die Nutzung von Verkehrsmitteln zu schaffen. Eine Förderung ist zwar möglich, sehe ich aber nicht Definitionsmerkmal an. Darüber hinaus können auch private Mäzene oder Unternehmen fördern."

The other commenting evaluators make similar assessments. The evaluator from the energy industry even states that subsidies are not only a small part but the smallest of what is important when describing the role. And the commenting evaluator from manufacturing adds that the regulatory framework and the regulatory conditions should ease the implementation and profitability.

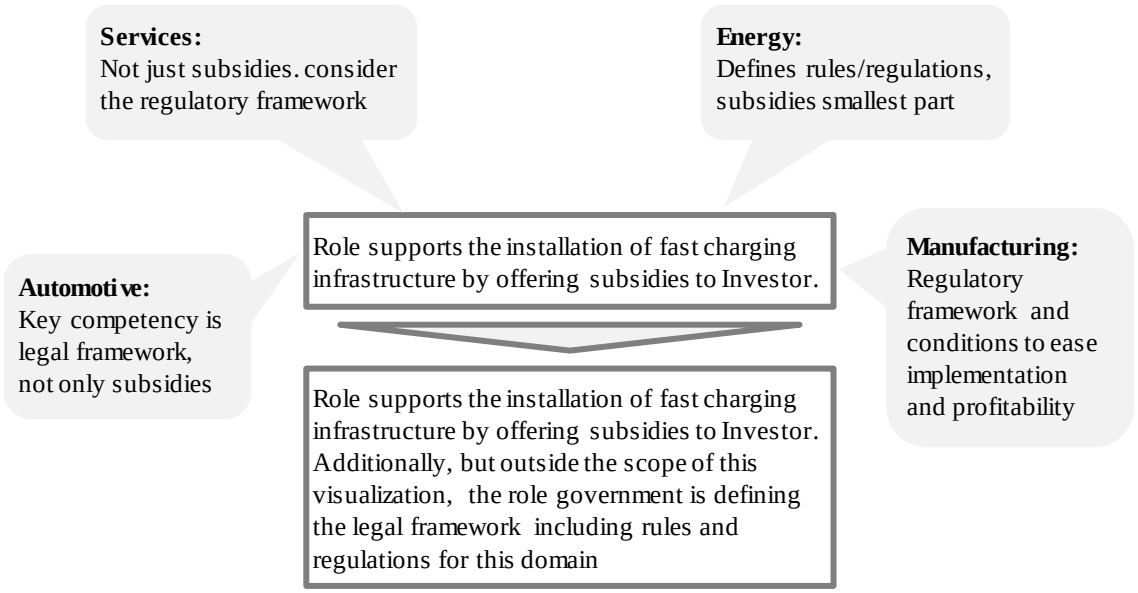


Figure 66 - Revised description of the role 'Government' based on the expert evaluation

After displaying the results of the evaluation of the VPED of the domain of fast charging infrastructure in Germany, a model of the value creation and exchange, these results are being discussed in the subsequent chapter.

6.2.3 Discussion of the evaluation results

The evaluation of the frame of reference of the domain of fast charging infrastructure reveals several interesting facts that are discussed in the following. Firstly, the overall agreement with the model of value creation and delivery for the new domain is very high. The evaluators don't add any additional role, and they do not delete any element, either. Out of 50 element descriptions being evaluated by the seven experts from different industries active in the new domain, only eight disagreeing answers are given, which accords to approximately 2% of all responses. In other terms, there is an approval rate of 98% for the views instantiation in the domain. This can be considered an indicator that the model of the value creation and delivery in the field is close to reality. Therefore, transparency and a common understanding amongst stakeholders about value creation and delivery based on the VDAM approach can be reached. Communication between stakeholders based on this view is possible, because the evaluators use the model and the corresponding description to discuss and argue their cases. This overall good result indicates, that subsequent analysis of the domain, as displayed in Chapter 5.2, can be feasible for model designers and stakeholders. As this view is the basis for redesigning the value network as presented in Chapter 5.3, it is an additional indicator that this step of the instantiation is of value as well, besides the fact that the participants of this case study are satisfied with the model.

While the overall approval by the evaluator is a promising result for the VDAM approach, the high number of comments allows conclusions of its own. The fact that almost every element of the model is commented on is a sign that, even though many hours were invested in modeling and describing the elements, every stakeholder still has a view of her own on the topic. This confirms the deductions made on why the individual views on value creation and delivery in the domain are so diverse in the initial study (see Chapters 3.5 and 3.6). Because most comments are highly individual remarks on specific aspects of the model, I refrain from changing the ontology at this point. Changes would need to be discussed amongst the stakeholders and at least a second round of evaluation would be required. As stated before, time is a very limiting factor for this evaluation. That is why adjustments and re-evaluation are not carried out as part of this research project. One exception to this general rule is made: as shown in Figure 66 and described in Chapter 6.2.2, all evaluators that comment on the role 'Government' (B) state that this role is creating the legal framework for the domain. The consensus amongst the evaluators is considered reliable. Therefore, an adjustment to the ontology is made, stating that the role 'Government' (B) is defining the legal framework for this domain, including rules and regulations while the corresponding value propositions to all roles are not displayed in the VPED (see Figure 66). A visualization of this fact in the VPED is not deemed constructive because a visualization would require a value proposition from the 'Government' role (B) to every other role in the frame of reference. The value-add of such a visualization is not deemed relevant. Independent from the discussion if or how the visualization or description might be changed, based on the comments from the evaluators, one conclusion is possible: results of the VDAM approach, namely the VPED

of the domain including the description within the ontology, can be used to communicate and discuss the value creation and delivery network in a domain. This can be considered an indicator that the framework can be effective in the sense of Hevner et al. (2004) and Venable at al. (2012).

While the results appear to be valuable and show potential for the application of VDAM in the domain of fast charging infrastructure in Germany, one limitation should be mentioned: only seven of the initially 18 experts participated in the evaluation. This rather low rate of response might be explained by two factors: Firstly, more than a year since the initial study has passed. Secondly, as confirmed by several experts who answered by email or phone, time is a very limiting factor, indeed. Several experts stated via phone or email that they consider the visualization of the value creation and delivery of this new domain highly interesting and that they forward it to colleagues to use it within their organizations. Even though they appreciate the results, they stated that they simply don't have the time to conduct the survey and answer the questionnaire. While this is disappointing out of a scientific perspective, I deem it as a good sign for the pragmatic validity of the models' instantiation. Nonetheless, while being explicable, the low response rate of the evaluation limits the significance and validity of the evaluation to a certain degree.

In conclusion, the results of the evaluation of the VPED for the domain of fast charging infrastructure in Germany are highly promising. The limited number of replies leads to some restrictions concerning the validity of the evaluation and the results should not be overrated. Nonetheless, the high degree of agreement with the model and the corresponding description of the participating evaluators is an indicator that modeling with the VDAM framework leads to a model of the value creation and delivery in the domain that is of value. The instantiation of the framework in the domain creates a model that is close to reality that most evaluators can relate to, even though their perspective on the domain was partly different before this unifying view was modeled with the VDAM framework. Therefore, while keeping the limitations in mind, the effectiveness of the artifact for the domain of fast charging infrastructure in Germany can be assumed.

6.3 Extended evaluation of VDAM concerning its applicability in other domains

As shown in Chapter 0, the VDAM framework can be applied to the domain of fast charging infrastructure. An empiric explorative study on business models in this field was the motivation for the development of the framework. As the evaluation of the frameworks instantiation shows, the resulting value proposition exchange diagram sufficiently correlates with the real world and therefore can be of value to stakeholders in the domain (see Chapter 6.2). Evaluating if the approach might be applicable to other domains is of interest as well. Due to limited time and missing access to companies of other areas to conduct a comprehensive application of the approach in another domain, a more pragmatic approach is applied to

evaluate the potential usability of VDAM. Subsequently, the setup of the evaluation towards usability in other fields is introduced (see Chapter 6.3.1). This is followed by displaying the results of the evaluation (see Chapter 6.3.2) and their discussion (see Chapter 6.3.3).

6.3.1 Setup of the evaluation

As stated above (see Chapter 6.1), evaluations face challenges and limitations based on certain factors. Key limiting factors for the evaluation of the VDAM approach in other domains are time and access to people from companies active in other areas. Therefore, instead of applying the whole framework to a new domain, a different approach is applied.

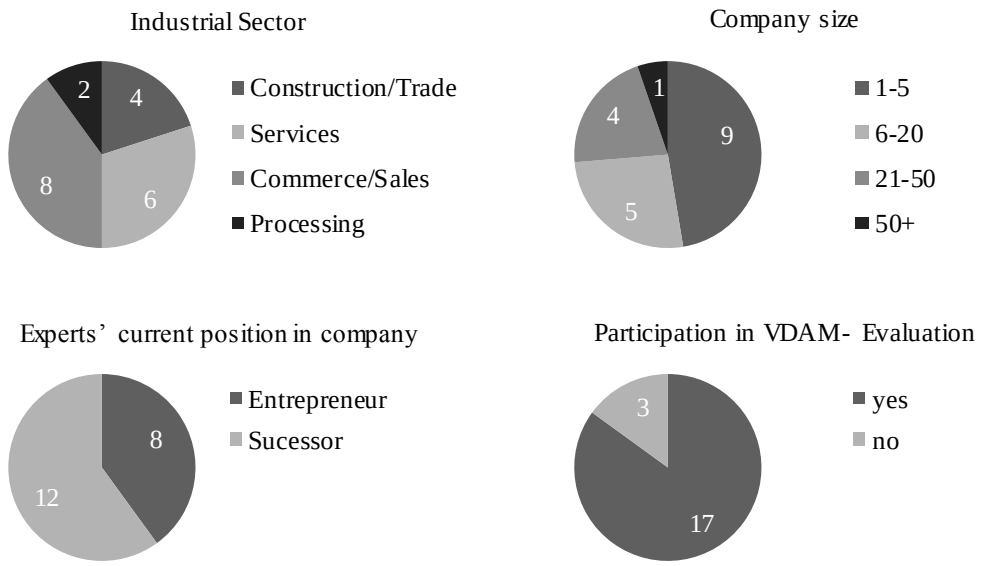


Figure 67 - Participants' background for the extended evaluation of VDAM

With a group of 20 participants, a one day workshop including a real world case study is conducted. The 20 people are either entrepreneurs, owning a company or are company successors, planning to take over the family business. The participants' companies are mostly located in more traditional industries, namely construction/trade, services, commerce/sales, and processing. While these industries tend to have a more mature logic of value creation and delivery, globalization, digitalization, and comparable trends are relevant challenges with the potential to change these value networks as well (Kauffman et al., 2010). Furthermore, as young entrepreneurs or potential successors in well-established companies, the participants show the motivation to change existing routines to advance the companies and sometimes already have specific

ideas in mind on how to do that. The companies of the participants are all small and medium-sized enterprises (SME)[5].

After an initial introduction of the VDAM framework, four groups are formed. Afterward, each group chooses the domain of one participant to conduct the case study. Therefore, this evaluation can be considered a naturalistic approach as well. Because all participants know each other for years, the knowledge of every team member about the case study industry is deemed sufficient to proceed with the case study. The case study itself is divided into three phases. In phase one, every participant is supposed to conduct a short domain analysis and model the first draft of a value proposition exchange diagram. In the second phase of the case study, each group comes together with the goal to model a unified perspective on value creation and delivery in the respective domains. Based on this unified perspective, companies active in the domain are positioned, and analyses as described in the framework (see Chapters 4.5 and 5.2) are conducted. In the last phase, possible changes to the value creation and delivery in the domain based on digitalization are modeled and assessed. Based on this setup, the participants of the evaluation conduct typical steps of the VDAM framework, without the modeling of more detailed views. The description of the elements modeled is also carried out in a reduced way, due to time limitations. Nonetheless, the evaluators experience the framework in a condensed mode that allows a preliminary evaluation.

This evaluation is conducted based on a short survey (see Table 14). The evaluation takes place at the end of the workshop and is voluntary. As shown in Table 14, statements to evaluate are mainly concerned with the goals of the VDAM framework. Two statements focus on determining if the approach facilitates communication and strengthens the understanding of value creation and delivery. Furthermore, the evaluation is concerned with the question if the approach enables the positioning of companies in the frame of reference and if the subsequent comparability of enterprises is created. One statement is aiming at evaluating if the development and visualization of business model ideas based on VDAM are valuable. Another aims at assessing the potential to support the operationalization of business models. Besides evaluating these statements to determine if VDAM has the potential to fulfill its claims, its effectiveness, and usability, two more statements target a broader scope. The evaluation of these two statements aims at determining if VDAM can be generally valuable as a complement in the area of business modeling and if the participants, entrepreneurs and company successors, consider applying the framework in their company. Besides evaluating the VDAM framework based on their agreement with the statements, the participants have the opportunity to comment on the framework in general in an open comment section.

[5] SME: “The category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises, which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million.” (European Commission, 2003, 2016).

Table 14 - Questionnaire for the evaluation of usability and value of VDAM in other domains

No	Statement	I fully agree with the statement	I agree partly with the statement	I disagree with the statement
1	VDAM facilitates the communication and discussion about the value network in a domain			
2	VDAM strengthens the understanding of a value network in a domain			
3	VDAM enables the exact positioning of companies in a value network of a domain			
4	VDAM creates comparability of companies including their positioning in the value network			
5	VDAM enables the development of new business model ideas and visualizes their impact on the value network			
6	VDAM supports the operationalization of business model ideas by enabling the modeling of different perspectives			
7	VDAM is a valuable complement in the area of business model description and development			
8	I will apply VDAM in my company, because it complements my personal toolset for strategic questions in a meaningful way			

The goal of the workshop and the subsequent evaluation is to determine if the approach can fulfill its claims and if the VDAM approach has the potential to be of value to other domains as well. The claims or goals of the approach that are under evaluation are the creation of transparency, the facilitation of communication and analysis, and altogether the increase of comprehension of value creation and delivery in a domain to assist an informed decision on business model ideas. The value for other areas is determined by the usability and effectiveness, both in the sense of Hevner et al. (2004) and Venable (2012).

6.3.2 Results of the evaluation

As shown in Figure 67, seventeen of the twenty entrepreneurs and company successor participate in the evaluation of the VDAM framework at the end of the one-day workshop, held on December 16th, 2016 in Karlsruhe. As stated above, the evaluation covers three topics: first, the goals of the VDAM framework are evaluated, especially the ones based on the VPED, which represents value creation and delivery in a domain. Secondly, the evaluators' perspectives of the usefulness of VDAM as a complementing approach to business modeling in general and for their companies, in particular, is assessed. Finally, comments towards the approach, in general, will be displayed.

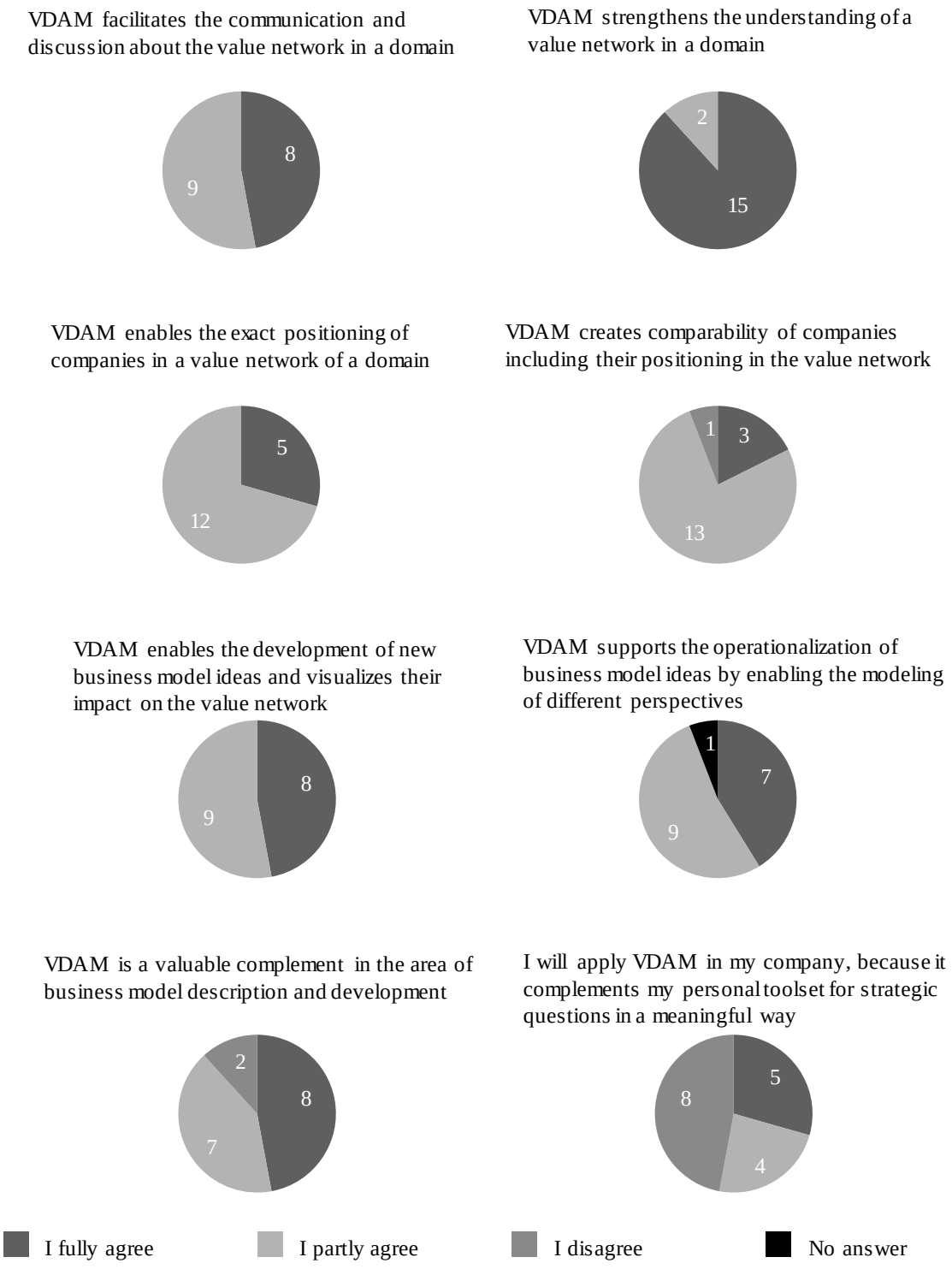


Figure 68 - Evaluation results concerning the applicability of VDAM in other domains

Beginning with the goals of VDAM, all evaluators state that VDAM either fully or least partly facilitates the communication and discussion about the value network of a domain (see Figure 68). An even higher agreement exists towards the statement that the VDAM framework strengthens the understanding of the

value network in a field. Almost 90% of the evaluators fully agree with the statement, and only two partly agree. As shown in Figure 68 the exact positioning of companies in the value network, 12 evaluators partly agree, and five fully agree. Again, no evaluator disagrees with the statement. The evaluation results on the creation of comparability of companies based on the positioning in the value network differ a bit. While 13 evaluators partly agree and three still fully agree, there is one evaluator that disagrees with this statement.

The statement that VDAM enables developing new business model ideas and assists by visualizing their impact on the business model is again without opposition (see Figure 68). No evaluator disagrees with the statement, nine partly agree, and eight fully agree with it. Looking at the statement that VDAM supports the operationalization of business model ideas, one evaluator did not deem herself capable of answering. From the remaining sixteen, nine partly agree with it and seven even fully agree with it. Again, there is no opposition to the statement.

Looking at the evaluation of the more general statements towards VDAM the results are more diverse (see Figure 68). Eight evaluators fully agree with the statement that VDAM is a valuable complement in the area of business model description and development and seven at least agree partly. Two of them disagree with the statement. The last statement about VDAM is concerned with the future application of the approach by the entrepreneurs and company successors. Five evaluators agree with this statement that they will apply it and four partly agree. Eight evaluators disagree with the statement and therefore are not considering to use VDAM in the future.

The eight written comments towards the VDAM approach by the evaluators have three main topics: challenges of VDAM, potentials how to improve VDAM, and a general assessment of the approach. Beginning with the challenges, two evaluators state that the approach is highly time-consuming. Six evaluators call it a complex approach to work with. The evaluators also make suggestions on how to improve it or make it easier to understand and apply. Two ask for more and better examples to explain the different views, and corresponding diagrams and four ask for some tool or even a software tool to assist the modeling with VDAM and the subsequent analysis as part of the framework. Looking at the general assessment as part of the comment section, one evaluator deems the approach too complicated and time-consuming to be of value for new business areas. Four evaluators, on the other hand, consider it a good and valuable approach, at least if some improvements, e.g. an assisting software tool, would be available.

6.3.3 Discussion of the evaluation results

The evaluation of the VDAM framework in other domains shows some interesting results which need some interpretation due to the specific context of the evaluation. The evaluators are all entrepreneurs or company successors in rather stable, old economies and own or will own SMEs. Furthermore, the

evaluators did not know the VDAM framework until the beginning of the one-day workshop and conducted the evaluation at the end of the day.

Looking at the statements 1-6 which aim at the goals of VDAM, only one evaluator disagrees with one statement. All other evaluators either partly or fully agree with all the statements. This result is an indicator that the VDAM approach might be of value to other domains, even domains with rather stable value networks. The VDAM aspect of creating a more in-depth understanding of the value network is evaluated the best. In my opinion, a more thorough understanding of the value network is a highly important input for more informed business model decisions. This result of the evaluation is a success for VDAM. According to the evaluators, using the resulting views of the VDAM approach to discuss value creation and delivery and to use it as an enabler for communication receives a high level of support as well. The same holds true for modeling of new business model ideas and their effects on the value network. The still highly supporting but overall weakest evaluation by the entrepreneurs and company successors is made for the positioning of enterprises in the frame of reference and the comparability of enterprises based on that positioning. Overall, the evaluation of the goals of VDAM is highly promising towards the fact that the framework has the potential to fulfill its claims of creating transparency, supporting communication, and enabling a more informed decision on business models. Additionally, this indicates usability and effectiveness for other domains. Hence, VDAM has the potential to be of value to domains other than installation and operations of fast charging in Germany as well.

Another positive result of the evaluation is the fact that almost all evaluators consider the VDAM framework an approach that can be a valuable complement to existing business modeling approaches. This result shows that the VDAM framework seems to have the potential to address a topic of business modeling that might have been underrepresented (see Chapter 2.2.3). Considering VDAM as potentially interesting as a complement to other business modeling approaches is one thing. Planning to apply the approach yourself in the future in your company shows a different level of conviction that the approach might be of value. Therefore, I consider it a promising result that more than half of the entrepreneurs and company successors at least consider to apply VDAM in the future.

As displayed above, some evaluators used the comment section of the evaluation sheet. This feedback is of importance to the framework as well. One expert uses the opportunity to raise criticism of the approach, calling it not useful for modeling unknown or new domains. Her reasoning is based on the complexity and time consuming aspects of the approach. While other experts consider the VDAM approach valuable, most of them raise the issues of complexity and duration as well. This evaluation matches my experience when instantiating the approach in the domain of fast charging infrastructure in Germany (see Chapter 0) and while observing the participants of the one-day workshop (see Chapter 6.3.1). Modeling of abstract roles and value propositions can be a challenge, the complexity of today's business environments is demanding,

and the iterative aspect of the approach is time consuming. The evaluators' propositions on how to improve the approach can be a valuable input for future enhancements to the VDAM framework. A supporting software tool, guiding the model designer and assisting with certain tasks, e.g. filling in parts of the ontology while modeling the visualization, can reduce complexity and save time while working with the VDAM approach. Nonetheless, while at the current stage there is still a lot of manual labor involved when working in accordance with the VDAM approach, most evaluators seem to see some value in these efforts.

On a different note, the before mentioned fact that the evaluators are heading small companies and some of them are entrepreneurs themselves indicates that the approach can have some value to entrepreneurial engagement as well. The instantiation of the VDAM framework (see Chapter 0) is conducted based on the interviews of the empiric exploratory study in the domain of fast charging in Germany. Most of the interview partners are from big corporations, e.g. from the energy sector or automotive industry (see Chapter 3.2). This affiliation with big companies holds true for the evaluation as well (see Chapter 6.2). Therefore, the fact that the evaluators of this extended evaluations are from SMEs allows the conclusion that there are signs that there is some entrepreneurial importance to the VDAM framework as well.

Even though the results are promising, the evaluation faces some challenges and restrictions that need to be considered when interpreting the results. The evaluators know the VDAM framework only for one day when making their assessment. Hence, the evaluators do not have the time to get to know the framework in detail and depth. Therefore, the results of the evaluation need to be considered preliminary, and conclusions drawn from the evaluation need to be made carefully. I try to meet this requirement of careful evaluation by not postulating general usability and effectiveness of the VDAM framework in other domains, even though the results look promising towards its potential.

6.4 Conclusion

Both, the results of the instantiation (see Chapter 6.2) and the VDAM framework itself (see Chapter 6.3) show potential for future applications of VDAM. As stated above, following Venable (2008), the successful instantiation of VDAM in the domain of fast charging infrastructure in Germany can be considered a validation of the approach (see Chapter 0). Additionally, evaluation steps to determine the value of the instantiation, especially sufficient similarity to the real world (see Chapter 6.2) and towards a more general usability of the framework (see Chapter 6.3) have been conducted. The overall results of these evaluations show that the key goals of VDAM seem to be reachable. The VDAM framework is a tool that enables communication about complex value networks and the positioning of companies in a domain (see Chapter 5.3.2, 6.3.2, and 6.3.3). Additionally, by allowing the exact positioning of enterprises in the visualization of the value network, VDAM enables the creation of transparency and the opportunity to conduct analysis and learn about potentials and threats in a domain. Understanding the current value creation of a field

allows detecting potential for how to create efficiencies and new business possibilities by offering new value propositions.

On the other hand, as the study with entrepreneurs and company successors shows, the approach is not simple and requires time to get accustomed to. This is especially true regarding the abstraction towards roles, thereby leaving behind companies. Abstraction is particularly challenging when experts reflect on their own company. Nonetheless, the entrepreneurs and company successors participating in the workshop and the evaluation see that the goals of the VDAM framework are reached and that the approach can be a valuable complement to existing business modeling approaches. More than half of the evaluators have stated that they will or that they might apply the approach in their company. While certain restrictions and limitations exist for the evaluation of the VDAM framework, I consider the results a successful proof of concept that VDAM has the potential to be applicable in and of value to other domains as well.

To facilitate the usability and effectiveness of the framework, the evaluators from the extended evaluation propose a supporting software (see Chapter 6.3.2). Taking my experiences of instantiating the framework in the domain of fast charging infrastructure (see Chapter 0) into account, I agree with their assessment. Especially the ontology building takes a lot of time, especially because it is an iterative approach. If a software tool would prefill certain aspects of the ontology, e.g. the attributes 'Target Role', 'Received Value Proposition from Offering Role', 'Offering Role', and 'Offered Value Proposition to Role' of the role elements, while modeling, a lot of time would be saved. Especially because modeling according to the VDAM framework is an interactive approach, manually adjusting the ontology elements and keeping them consistent is a delicate matter.

In conclusion, VDAM seems to have the potential to reach its goals and be of value to entrepreneurs, company successors, and managers working in changing or new business environments. The evaluation of the instantiation of the frame of reference for the domain of fast charging infrastructure reveals a very high degree of agreement with the result of the modeling efforts. This result supports the instantiation of the framework and in addition to that the validity of the VDAM in this domain. The positive results of the evaluation of VDAM framework applicability in other domains indicate that the framework can be of value to other domains as well. While the results, in general, are highly promising, the limitations and restrictions of the evaluation should be kept in mind. Therefore, I refrain from calling the VDAM framework of general value or even universally valid. However, the potential of VDAM should not be denied.

7 Discussion

This last chapter summarizes the findings of this research project and provides an outlook for researchers and practitioners. Therefore, Chapter 7.1 is concerned with a discussion of the research project, the guiding research questions, and the findings and answers provided by this dissertation. In the spirit of design science, relevance for practice is important. Thus, Chapter 7.2 focusses on the implications for practice. This is followed by displaying the limitations of this research project and propositions towards future research in this highly relevant research domain (see Chapter 7.3). This chapter ends with a short overall conclusion (see Chapter 7.4).

7.1 Purpose of the research and summary of the findings

This dissertation in management studies has been motivated by personal experience and an empirical explorative study in the domain of fast charging infrastructure in Germany (Metzger et al., 2016, 2015). The domain is characterized by a very complex and uncertain environment, leading to an insufficient availability of publicly accessible fast charging infrastructure. This, in turn, threatens the market penetration of electric mobility (Nationale Plattform Elektromobilität AG 3, 2015), which is one of the key enablers for the reduction of greenhouse gas emissions and climate change (Intergovernmental Panel on Climate Change, 2007). Among other variables, reasons for this complexity and uncertainty are the involvement of diverse industry sectors, the lack of a well-established value network, and the absence of profitable business cases. The search for adequate business models has been one of the major challenges over the past few years (Nationale Plattform Elektromobilität, 2014; Reinke, 2014). Therefore, the motivation for this research project is the search for a business modeling approach that responds to these challenges. To guide this research process, three research questions have been identified. Subsequently, the answers to these research questions provided by this dissertation will be summarized:

1) *What differing meta-models for the description of business models exist and how can they be applied in the domain of fast charging infrastructure?*

As discussed in Chapter 2.2, there is still no universal definition of what a business model is (e.g. Bieger et al., 2011; McGrath, 2010; Onetti et al., 2012; Van Aken & Romme, 2012; Zott et al., 2011) but there is consensus on what business models are primarily used as (Al-Debei & Avison, 2010):

- A conceptual tool for alignment between strategy and business process.
- An interceding framework between technological artifacts and attainment of strategic goals.
- Strategic-oriented knowledge capital that answers questions related to value creation.

Today, there is a trend towards growing complexity of business models caused by hyper-competition and globalization (Onetti et al., 2012). This situation leads to specific requirements for business modeling approaches: business modeling approaches need to display a systemic view of the company and its environment to effectively and efficiently foster value creation (Golinelli, 2010; Jones, 1999; Onetti et al., 2012). They facilitate decision makers to understand the value creation network and support the successful positioning of companies within this network (Metzger et al., 2016). The before mentioned situation in the domain of fast charging infrastructure in Germany is a good example of these new challenges caused by complexity.

As the analysis of three business model approaches in Chapter 2.2.3 indicates, these additional requirements are only fulfilled to a certain degree. The analyzed business modeling approaches are the Business Model Canvas (Osterwalder & Pigneur, 2010), Business Model Navigator (Gassmann et al., 2013), and Business Model Cube (Lindgren & Rasmussen, 2013). To conduct the analysis, the V^4 business model ontology by Al-Debei and Fitzgerald (2010) is applied as a frame of reference. While all three approaches score high or very high in the dimensions value proposition, value architecture, and value finance, the dimension value network seems to be underrepresented. Understanding the underlying logic of value creation in the domain based on roles and actors is not part of the focus of these approaches (see Chapter 2.2.3). Thus, prevalent business model approaches are not an ideal fit to address the challenges of the new domain of fast charging infrastructure in Germany.

However, there is a new business modeling language with promising features to answer the challenges of today's business model environment: Value Delivery Modeling Language by the Object Management Group (2014, 2015). Besides incorporating existing approaches, VDML offers opportunities to address the topic of positioning or embeddedness in the value network while modeling business model ideas and innovations (see Chapter 2.2.4).

2) How can complex value streams in the domain of fast charging infrastructure be displayed and what potentials exist?

VDML incorporates several promising views and diagram types that can be of value to visualize complex value streams (see Chapters 2.2.4, 3.5, and 5.1.1). In this context, the Value Proposition Exchange Diagram is of particular importance. VPED consist of three types of elements, namely roles, value propositions and connectors (Object Management Group, 2014, 2015). As shown in Chapter 3.5, this type of diagram can be used to visualize the experts' perspectives on the value network of the domain of fast charging infrastructure in Germany (see Figure 33). The fact that VPED is based on abstract roles is of particular interest and value for this work. Business modeling approaches such as the Business Model Canvas by Osterwalder and Pigneur (2010) ask for key partners, which implicitly leads the model designer to think about specific companies. By applying the VPED, on the other hand, the model designer is guided to reflect

on the general logic of value creation and delivery, leaving specific companies behind. The VPED allows to determine the differences in the perspectives on value creation, facilitates transparency and creates an initial comparability between the different views, which otherwise would not have been possible. Therefore, the VPED as a view of VDML is a valuable tool to display complex value streams.

Additionally, it is important to notice that VDML has the purpose to act as an intermediary framework between strategy and business process modeling. Therefore, it provides different types of models and views, allowing different perspectives on a business model (see Chapter 2.2.4). These diagrams and views can be used individually or be combined into coherent systems, as shown in Chapter 2.2.4. A specific implementation for this potential to combine views is provided in Chapter 5.3, as part of the case study in the domain of fast charging infrastructure in Germany. Hence, as described in Chapter 4.2 and instantiated in the domain of fast charging infrastructure in Germany (see Chapter 5.3.3), VDML views can be used to deepen the understanding of complex value streams as well.

Even though VDML diagrams and views can be used to display complex value streams in the domain of fast charging infrastructure, they are not sufficient in answering the challenges of this complex value network. As the visualization of the experts' perspectives highlights, the domain suffers from the absence of a standard level of abstraction when talking about business models, roles, and value propositions. Additionally, a shared cross-company vocabulary is missing, hindering collaboration. Furthermore, people active in the domain tend to use patterns associated with their company. The absence of an established value network is depicted by the fact that experts even have significantly different convictions of how value is created in this new domain (see Chapter 3.6). The modeling of VDML views helps to identify these additional challenges, but they cannot be solved by VDML alone. I argue that an overall framework that incorporates valuable views from VDML is necessary in order to overcome these challenges.

While the VDML shows great potential to enable decision makers to understand the value creation network and support the successful positioning of a company within this network, the results of the initial modeling with VDML views (see Chapter 3.5 and 3.6) show the need for a conceptual framework. As part of this framework, a common understanding of the value creation needs to be established in order to answer the challenges of the domain of fast charging infrastructure in Germany.

The first two research questions and the corresponding answers are of crucial importance to guide this research project towards its core, the third question:

3) *How can a meta-model improve the development of innovative business models and support the enhancement of their operationalization?*

The VPED of VDML is a valuable artifact to display the value network of a domain. Further views and diagrams of VDML can deepen the understanding and support the subsequent operationalization. This alone is not sufficient to tackle today's challenges of business modeling in complex value networks. Additionally, it is important to create a shared understanding amongst all stakeholders and to improve the communication between them. Therefore, I deem it valuable to create an overall framework that combines views from VDML (see Chapter 4.2) with semi-formal ontology building (see Chapter 4.3). I name this approach Value Delivery Architecture Modeling framework.

As introduced in Chapter 4.5, this framework is based on an iterative process between modeling different diagrams and views of VDML and describing these views in an ontology. A prerequisite for this iterative process is a domain analysis, which can be conducted according to the preferences of the model designer, e.g. based on industry reports, quantitative analysis, and expert interviews. Based on processing and interpreting the gathered information, it is possible to model a first version of the relevant diagrams. Modeling within VDAM implies the description of the value creation network using the VPED. Additionally, to ensure conceptual clarity and a common language, it is vital to describe the results in the semi-formal ontology. The design of the diagrams and the development of the ontology is an iterative process. The development of additional, underlying diagram types makes use of the ontology that has emerged at that stage of the process. These diagrams, in turn, have the potential to create new questions, triggering a process of additional empirical information gathering. This new knowledge will be made explicit by including it in the ontology, thereby providing enrichment and enhancement. The finished VDAM artifact creates an explicit frame of reference for the value creation network of a given domain, which can be of value in various situations:

- They help an entrepreneur or a BMI team to clearly position and align.
- They help to create a common understanding among stakeholders about value creation and delivery, thereby facilitating cross-company and cross-industry collaboration.
- They help to analyze existing business models and create the basis for evaluation and (re-) design.

As shown by the instantiation of the approach in the domain of fast charging infrastructure in Germany (see Chapter 5.1) and confirmed by its evaluation (see Chapter 6.2), VDAM meets its objectives: the approach creates transparency and comparability, supports the creation of a shared understanding, and improves the communication between stakeholders. Based on the frame of reference of the domain of fast charging infrastructure in Germany (see Chapter 5.1.1), the positioning of companies in the value network can be determined (see Chapter 5.1.2). Furthermore, creating a frame of reference based on the VDAM framework enables decision makers to conduct several types of analysis of the value creation network and the companies active in it (see Chapter 5.2.1, 5.2.2, and 5.2.3). Together, these reference points lead to a more informed decision on if and how to implement a business model idea in the domain of fast charging

infrastructure (see Chapter 5.2.4). As displayed in Chapter 5.3, the VDAM approach can also be used to redesign the value network. Based on a real-world problem, experts assessed how an idea would redesign the value network and what potential value propositions could be created by following their idea (see Chapter 5.3.2). In this case study, the use of the underlying VDML views as part of the VDAM framework is displayed. The understanding of their business models is deepened by modeling key processes in the Activity Network Diagram, necessary capabilities in the Capability Management Diagram, and relationships of elements in the Measurement Dependency Graph. Additionally, this increased understanding and modeling of the main aspects is the first step towards a potential subsequent operationalization of the idea (see Chapter 5.3.3). The instantiation of VDAM in the domain of fast charging infrastructure shows how this new tool can contribute to business modeling and enables users to a more informed decision on if and how to implement a business model (see Chapter 5.4). The subsequent evaluation of the key view of the approach, the VPED and the corresponding semi-formal ontology elements, confirms the potential of the approach for this domain (see Chapter 6.2).

The extended evaluation of VDAM with entrepreneurs and company successors from different fields shows promising results as well (see Chapter 6.3). Additionally, the results indicate that the approach might be of value to companies from other domains, even in domains with rather stable value networks. Although it is considered to be too complex to apply in a one-day workshop, most evaluators consider it a valuable addition to the toolset of business modeling approaches. Some have even considered using it in their companies and domains in the near future. Therefore, while it is a rather light evaluation, the results indicate that the framework has the potential to fulfill its claims of creating transparency, supporting communication, and enabling a more informed decision on business models in other domains as well. Nevertheless, due to the limitations of this evaluation, I explicitly refrain from arguing the general applicability of VDAM in other domains than fast charging infrastructure in Germany.

The motivation for this research project is the search for an adequate business modeling approach to answering the challenges of the fast charging infrastructure in Germany, namely complex value creation between companies from different industries, the absence of an established value network, and the lack of viable business cases. The result of this design research project is a new approach to business modeling that allows for analyzing, evaluating, and designing business models and their embeddedness in the value creation network. Additionally, this approach furthers transparency and comparability and facilitates communication among stakeholders involved. With respect to the model development itself, it is worth noticing that it is in accordance with the GoM, thereby enhancing clarity, consistency, and quality of the work. This new approach to business modeling is called Value Delivery Architecture Modeling.

7.2 Implications for practice

The post-industrial and globalized economy is characterized by specialization and the need for collaborative efforts for value creation across company borders. This leads to increased complexity in value creation. Additionally, new trends such as digitalization might result in the disruption of established value creation systems, as shown in a study on the German energy sector (Lau & Terzidis, 2016). A new approach to respond to these challenges by enabling decision makers to understand the value creation network and by supporting the successful positioning of a company within this network can be of value to entrepreneurs and managers affected (Metzger et al., 2016).

Value Delivery Architecture Modeling is an approach that complements well-known business modeling approaches. As shown within this research project for the domain of fast charging infrastructure in Germany, VDAM enables the modeling of complex value creation networks and the subsequent positioning of companies in this frame of reference. This does not only lead to transparency and comparability but enables several analysis types, which all lead to a more informed decision on if and how to implement a new business model in a domain (see Chapter 5.2). Additionally, the approach allows analyzing how a business model idea can redesign existing value networks, facilitating insights towards possible customers and competitors (see Chapter 5.3). As the evaluation of the instantiation in the new domain of fast charging infrastructure shows, VDAM enables communication between stakeholders in a domain (see Chapter 6.2) that previously could not agree on a common vocabulary let alone view on the value network in total (see Chapter 3.6).

Based on the findings of this work, I recommend (re-) assessing and (re-) evaluating the positioning in the value network to companies that are already active in the domain. As shown for the company from the automotive industry, the positioning of roles in the value network might not be ideal, yet (see Chapter 5.2.4). This might hold true for other companies active in the domain as well. Hence, companies can use the frame of reference developed for the domain to position their company in it, analyze their positioning, and make an informed decision on it. Furthermore, as shown by the case study on charging station data (see Chapter 5.3.1) the domain is still facing processual and technical challenges. Hence, if established companies or start-ups have ideas how to omit these challenges, they might have the opportunity to reshape the value network. The frame of reference can be used to assess this situation. Additionally, the complexity of the value creation network strongly indicates that companies need cooperation to implement successful business models. I recommend to companies to use the frame of reference and the corresponding ontology when talking to potential partners. As the initial study on the value network shows (see Chapter 3.5), there is no common vocabulary in the domain and the understanding about value creation is still highly heterogeneous. Hence, the frame of reference can be of value when talking to other companies by creating a common understanding between stakeholders. This holds true for companies and

stakeholders that already work together, because even the experts active in the same brain trusts show highly heterogeneous understandings on the value creation in the domain.

As the evaluation of the approach concerning its usability in and usefulness for other fields indicates, the VDAM approach shows promising potential for other domains as well. While the results do not prove universal applicability, many of the evaluators consisting of entrepreneurs and young company successors see value in the approach. Some of them have stated that they will apply the approach to their company and industry (see Chapter 6.3). If other entrepreneurs are inclined to follow their assessment, I recommend participating in future research projects for VDAM or simply applying the approach on their own. Alternatively, due to the fact that the approach is complex and might need some guidance, VDAM might have the potential for a commercial application in at least two ways. First (strategy) consultants could use the approach. Based on interviews, projects, and desk research, they can develop frames of reference for different industries and domains. These frames of reference could be part of their standard toolset to create transparency and a common understanding of the status quo. Furthermore, they could be used to discuss strategic options, thereby assisting companies to make more informed decisions about future business models. Second, as explained in Chapter 4, the VDAM approach is applying several views and logics taken from the Value Delivery Modeling Language. Because these artifacts are used rigorously within VDAM, and additional ontological efforts exist, the approach could be implemented into a software-based tool. Even though such an implementation was not conducted within the research project, experts from different domains would appreciate a supporting tool for modeling in accordance with the VDAM framework, reducing their efforts and giving assistance while modeling (see Chapter 6.3). Hence, there might be a certain willingness to pay for an assisting software-tool.

The VDAM approach can be of value and relevance to entrepreneurs and managers from domains with uncertain or changing value networks. Actors from the charging infrastructure domain in Germany can use the developed frame of reference to make more informed decisions on new business models. Entrepreneurs and managers from other domains can either apply the approach on their own, or can seek the help of consultants to prepare more informed decisions. If entrepreneurs should decide to commercialize the VDAM approach via a new software-tool, this could be used as well. In any way, the VDAM approach can complement their previous efforts and create value to these companies.

7.3 Limitations and future research proposals

This dissertation is subject to several limitations which could potentially be omitted by future research projects. Additionally, it offers starting points and opportunities for future research projects due to aspects that are out of scope for this work (see Chapter 1.2). First, as mentioned above, the general applicability of VDAM in other domains cannot be assumed. While the results for the domain of fast charging infrastructure

in Germany are promising and evaluators from other areas see the value of the approach, proof of broad general applicability cannot be delivered. While some industry access has been granted for the case study in the domain of fast charging infrastructure, additional access to other industries could not be realized. A step towards the proof of more general usability and applicability of the approach could be made in two ways. First, additional in-depth case studies could be conducted, and the results could be compared with this work to determine if the approach shows the same level of value to other domains. For this type of research project, access to companies and industries would be required. Nonetheless, following Eisenhardt and Graebner (2007), this would connect rich qualitative evidence to mainstream deductive research. A more quantitative research approach could be assumed if a supporting software tool would be developed by researchers or launched by a company. Such a study might reach a diverse group of people applying the tool, leading to quantitative results.

Second, the profitability assessment within the VDAM framework (see Chapter 4.4) has not been instantiated in the domain of fast charging infrastructure and therefore cannot be considered to be validated. This is due to the fact that the data generated by the initial study (see Chapter 3) does not reveal enough detail to apply this aspect of VDAM purposefully. Unfortunately, experts denied requests to more detailed information, which was directly impacted by my affiliation with a company active in the domain. At this point, I refrain from producing a fictional case that would allow its theoretical instantiation, because it would provide limited value to this research project. Instead, I propose future research projects and case studies to put some focus on this aspect of VDAM. Researchers not associated with a company active in the domain under analysis might get better insights, maybe as part of a government-funded project.

Third, while I was able to interview experts with various backgrounds from the automotive, energy, manufacturing, and services industry, my sample does not include experts from government or municipalities. Even though the roles ‘Government’ (B) or ‘Public Authorities’ (M) are rarely mentioned as strategic partners in the value network, the evaluation shows that these roles have a significant impact on the domain. Especially the role ‘Government’ (B) with the task to create a legal framework for the domain is highly influencial. Adding the perspective of government representatives might have offered additional insights on the value creation network in this new domain.

Fourth, after the successful instantiation of VDAM in the domain of fast charging infrastructure, the subsequent evaluation efforts within this work are focused on the Value Proposition Exchange Diagram. This diagram is key to the VDAM approach, and therefore its evaluation is of critical importance. Additional value might have been generated by evaluating the other views created for the new domain as well. A major hindrance for this additional evaluation was, again, access to evaluators from the domain. Even the experts who took the time to evaluate the VPED stated that currently there is very limited time to assist this research project due to the high workload within the domain.

This design science research project clearly indicates that VDAM is a valuable business modeling approach for the domain of fast charging infrastructure in Germany. However, as stated above, some limitations need to be made. Hence, future research concerning the VDAM is necessary to detect additional possibilities and constraints and thereby develop the approach further. On a more general level, I recommend further research associated with complex value creation in domains without an established value network or domains undergoing dramatic change due to technological advances. Understanding the value creation network and creating a new value proposition is one of the truly complex entrepreneurial tasks, especially in today's time. Therefore, research on this topic can create value for science and practice alike.

7.4 Conclusion

The post-industrial and globalized economy can be characterized as highly networked. In such context, focusing on core competencies and creating adequate partnerships with other companies are key strategic activities. As shown in this work, well-known business modeling approaches do not adequately account for the increasing importance of understanding the value creation network and the successful positioning of a company within this network.

The design science based research project to develop the Value Delivery Architecture Modeling is a first step to fill this gap. The goal of the VDAM approach to analyze, evaluate and design business models and their embeddedness in the value creation network. The application of this approach to the case of fast charging infrastructure for electric mobility in Germany gives a first impression of the breadth and depth of analysis that VDAM makes it possible and how it can complement existing business modeling methods.

The successful application of VDAM in the domain of fast charging infrastructure in Germany can also be considered as a validation of the framework. The evaluation of the instantiation in the domain of electric mobility in Germany has provided some evidence for its usefulness. The additional extended evaluation of its usefulness for other fields shows promising results but needs further confirmation by additional research projects and applications of the VDAM framework.

The first results are very promising, and I am confident that Value Delivery Architecture Modeling can be of value to researchers and practitioners. VDAM is based on the new expressive business modeling language VDML and semi-formal ontologies. As shown for the domain of fast charging infrastructure in Germany, these artifacts create an explicit frame of reference for the value creation network of a given domain, which can be useful in various situations. In conclusion, VDAM addresses one of the truly complex entrepreneurial and managerial tasks, namely understanding the value creation network, deciding on the positioning in that overall setup, and creating a relevant value proposition.

Appendix

Expert profile questionnaire

Expert Profile

Name: _____

Company: _____

Position: _____

What functions and tasks does that position include?

_____

_____

_____

For how many years have you been working in the field of electro mobility? _____

For how many years have you been working in the field of fast charging? _____

Have you been taking part in any government-funded e-mobility project? If yes, within which ones, what were your functions and when did that take place?

_____

_____

_____

_____

_____

_____

Have you been working in interest groups, consortia or associations like „Nationalen Plattform für Elektromobilität“, for example? If yes, within which ones, what were your functions and when did that take place?

_____

_____

_____

_____

_____

_____

Thank you very much for answering these questions!

Guiding questions for expert interviews

Questionnaire for the semi-structured expert interviews on installation and operations of fast charging infrastructure in Germany

1) Imagine a blank piece of paper. Which market roles in the context of fast charging do exist? And which roles are occupied by your company?
2) Specifically for your company: Within these market roles, what specific tasks and activities do you conduct?
3) For your company: What are the problems and challenges that your customers are facing in the area of fast charging and what solutions do you offer? Asked differently, what is your customer proposition
4) In more detail, what exactly do you have to do to deliver your value proposition?
5) Who are typical customers for your solutions? Under which circumstances and how often do they use it?
6) What resources and capabilities do you need to deliver your value proposition?
7) What channels do you use to address your target groups and to be in contact with them?
8) How important is the business segment fast charging for your company and how does it correlate with other value propositions made by your company?
9) Do you need partners to deliver the value proposition? If yes, who are they, what are their tasks and how much value do they contribute?
10) What are the three biggest revenue streams for your company in the business segment Fast Charging? What pricing models do you use for the different customer propositions?
11) What are the three biggest cost factors for your products and services in the area of Fast Charging?
12) To what extend is your value proposition in the area of fast charging a profitable customer proposition already? If not yet, what has to change to make it profitable?
13) Do you see other reasons than profit to participate in this new area of Fast Charging?
14) What Value Added Services does your company offer in the area of Fast Charging?
15) What kind of potential for Value Added Services based on the communications technology Power Line Communication do you see for your company? Or for other companies?
16) Within your role as an expert in the area of electro mobility: What other Value Added Services can be offered to the users of EVs?
17) Until 2020: What development for the business sector Fast Charging do you expect?

Rules of the transcription system - Regeln des Transkriptionssystems

Nr.	Regel	Beispiel
1	Ort und Datum des Gesprächs werden erfasst.	München, 01.08.2014
2	Der Dateiname der Audiodatei wird vermerkt, inklusive der Gesamtdauer der Aufnahme	Aufnahme 140804_0014: Dauer: 00:53:36
3	Die interviewende Person wird durch ein „I“, die befragte Person durch ein „B“, gefolgt von ihrer Kennnummer markiert	I: Hallo Frau G. #00:00:06-7# B2: Hallo #00:00:07-9#
4	Es wird wörtlich transkribiert, also nicht lautsprachlich oder zusammenfassend. Auch wiederholte Wörter, abgebrochene Wörter und Sätze werden notiert. Abgebrochen Wörter und Sätze werden mit einem „/“ markiert	DC-Ladestationen werden meistens mit/ auf 50kW ausgelegt
5	Deutliche, längere Pausen werden durch Auslassungspunkte „(...)“ markiert. Die Anzahl der Punkte spiegelt die Länge der Pause wieder. Wenn möglich wird der Grund der Pause erfasst	B2: Puh (…) das ist schwierig (…….. nachdenken). Fehlt mir jetzt gerade die zündende Idee.
6	Beim Sprecherwechsel werden Zeitmarken eingefügt	I: Hallo Frau G. #00:00:06-7# B2: Hallo #00:00:07-9#
7	Jeder Sprecherwechsel wird durch eine Leerzeile markiert, was die Lesbarkeit deutlich erhöht	I: Hallo Frau G. #00:00:06-7# B2: Hallo #00:00:07-9#
8	Nicht Verstandenes oder schwer verständliche Äußerungen werden mit (unverständlich + ungefähre Dauer)“ oder „(unv)“ versehen.	• Privatbereich und (unverständlich 10 sec) • Gestaltungsmöglichkeiten und (unv) beim
9	Lautäußerungen der befragten Person, die die Aussage unterstützen oder verdeutlichen (etwa lachen oder seufzen), werden in Klammern notiert.	B2: mhm (zustimmend).
10	Alle Angaben, die den Rückschluss auf eine befragte Person erlauben, werden anonymisiert.	Frau Maier → Frau M.

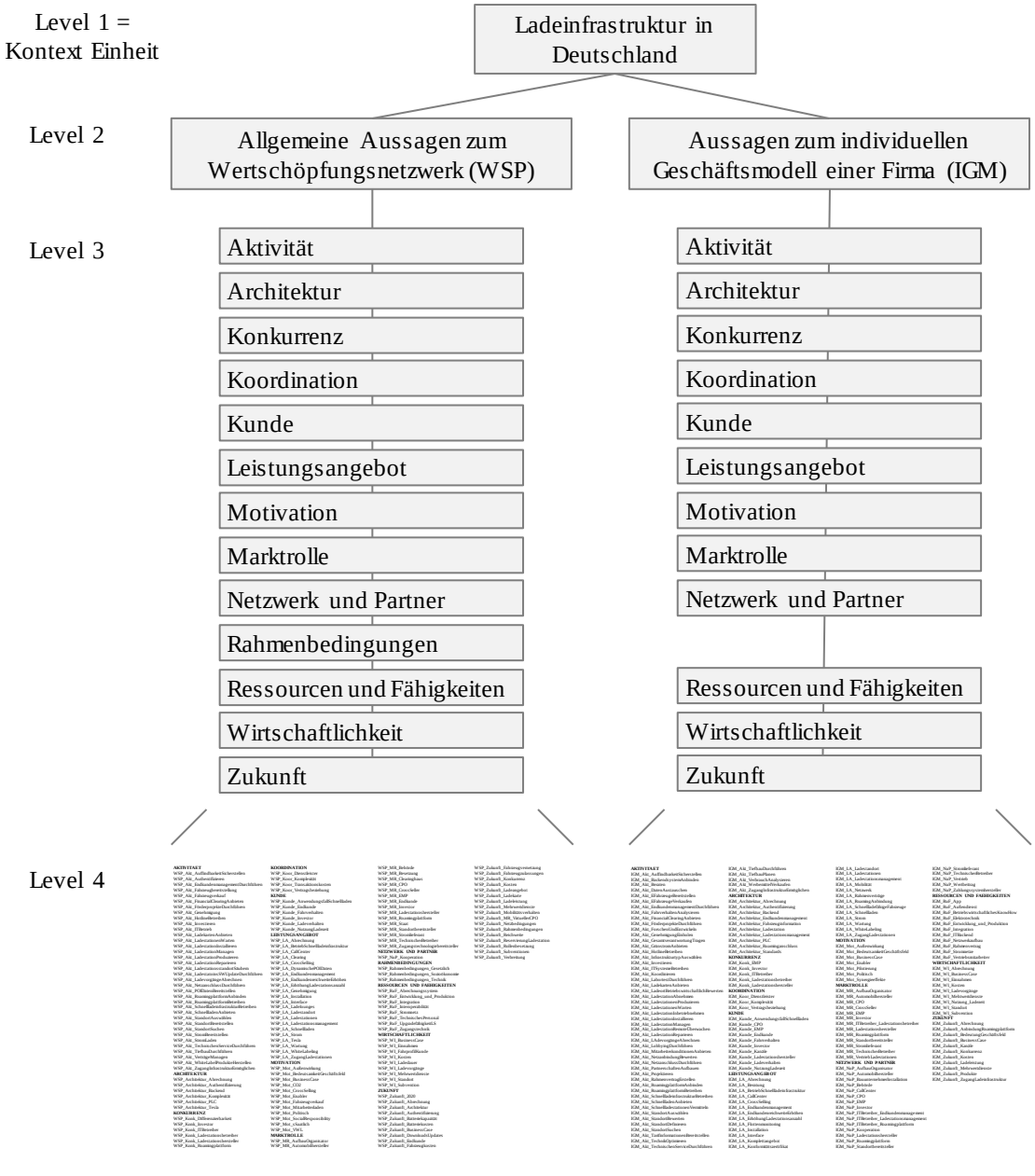
The transcripts of the expert interviews are available on request at

Institut für Entrepreneurship, Technologie-Management und Innovation (EnTechnon)

Fritz-Erler-Str. 1-3

76133 Karlsruhe

Code hierarchy Qualitative Data Analysis in Atlas.ti



Level 4 Code Hierarchy: Allgemeine Aussagen zum Wertschöpfungsnetzwerk (WSP)

AKTIVITAET
WSP_Akt_AuffindbarkeitSicherstellen
WSP_Akt_Authentifizieren
WSP_Akt_EndkundenmanagementDurchführen
WSP_Akt_Fahrzeugbereitstellung
WSP_Akt_Fahrzeugverkauf
WSP_Akt_FinancialClearingAnbieten
WSP_Akt_FörderprojekteDurchführen
WSP_Akt_Genehmigung
WSP_Akt_HotlineBetreiben
WSP_Akt_Investieren
WSP_Akt_ITBetrieb
WSP_Akt_LadekartenAnbieten
WSP_Akt_LadestationenWarten
WSP_Akt_LadestationInstallieren
WSP_Akt_LadestationManagen
WSP_Akt_LadestationProduzieren
WSP_Akt_LadestationReparieren
WSP_Akt_LadestationsstandortSäubern
WSP_Akt_LadestatoinsSWUpdateDurchführen
WSP_Akt_LadevorgängeAbrechnen
WSP_Akt_NetzanschlussDurchführen
WSP_Akt_POIDatenBereitstellen
WSP_Akt_RoamingplattformAnbinden
WSP_Akt_RoamingplattformBetreiben
WSP_Akt_SchnellladeinfrastrukturBetreiben
WSP_Akt_SchnellladenAnbieten
WSP_Akt_StandortAuswählen
WSP_Akt_StandortBereitstellen
WSP_Akt_StandortSuchen
WSP_Akt_StromBereitstellen
WSP_Akt_StromLaden
WSP_Akt_TechnischenServiceDurchführen
WSP_Akt_TiefbauDurchführen
WSP_Akt_VerträgeManagen
WSP_Akt_WhiteLabelProdukteHerstellen
WSP_Akt_ZugangInfrastrukturErmöglichen
ARCHITEKTUR
WSP_Architektur_Abrechnung
WSP_Architektur_Authentifizierung
WSP_Architektur_Backend
WSP_Architektur_Komplexität
WSP_Architektur_PLC
WSP_Architektur_Tesla
KONKURRENZ
WSP_Konk_Differenzierbarkeit
WSP_Konk_Investor
WSP_Konk_ITBetreiber
WSP_Konk_Ladestationsbetreiber
WSP_Konk_Ladestationshersteller
WSP_Konk_Roamingplattform
KOORDINATION
WSP_Koor_Dienstleister
WSP_Koor_Komplexität
WSP_Koor_Transaktionskosten
WSP_Koor_Vertragsbeziehung
KUNDE
WSP_Kunde_AnwendungsfallSchnellladen
WSP_Kunde_Endkunde
WSP_Kunde_Fahrverhalten
WSP_Kunde_Investor
WSP_Kunde_Ladeverhalten
WSP_Kunde_NutzungLadezeit
LEISTUNGSANGEBOT
WSP_LA_Abrechnung
WSP_LA_BetriebSchnellladeinfrastruktur
WSP_LA_CallCenter
WSP_LA_Clearing
WSP_LA_CrossSelling
WSP_LA_DynamischePOIDaten
WSP_LA_Endkundenmanagement
WSP_LA_EndkundenreichweiteErhöhen
WSP_LA_ErhöhungLadestationsanzahl
WSP_LA_Genehmigung
WSP_LA_Installation
WSP_LA_Interface
WSP_LA_Ladelounges
WSP_LA_Ladestandort
WSP_LA_Ladestationen
WSP_LA_Ladestationsmanagement
WSP_LA_Schnellladen
WSP_LA_Strom
WSP_LA_Tesla
WSP_LA_Wartung
WSP_LA_WhiteLabeling
WSP_LA_ZugangLadestationen
MOTIVATION
WSP_Mot_Außenwirkung
WSP_Mot_BedeutsamkeitGeschäftsfeld
WSP_Mot_BusinessCase
WSP_Mot_CO2
WSP_Mot_CrossSelling
WSP_Mot_Enabler
WSP_Mot_Fahrzeugverkauf
WSP_Mot_Mitarbeiterladen
WSP_Mot_Politisch
WSP_Mot_SocialResponsibility
WSP_Mot_sSaatlich
WSP_Mot_VWL
MARKTROLLE
WSP_MR_AufbauOrganisator
WSP_MR_Automobilhersteller

WSP_MR_Behörde
WSP_MR_Besetzung
WSP_MR_Clearinghaus
WSP_MR_CPO
WSP_MR_CrossSeller
WSP_MR_EMP
WSP_MR_Endkunde
WSP_MR_Investor
WSP_MR_Ladestationshersteller
WSP_MR_Roamingplattform
WSP_MR_Staat
WSP_MR_Standortbereitsteller
WSP_MR_Stromlieferant
WSP_MR_TechnischerBetreiber
WSP_MR_Zugangstechnologiebereitsteller
NETZWERK UND PARTNER
WSP_NuP_Kooperation
RAHMENBEDINGUNGEN
WSP_Rahmenbedingungen_Gesetzlich
WSP_Rahmenbedingungen_Sozioökonomie
WSP_Rahmenbedingungen_Technik
RESSOURCEN UND FAEHIGKEITEN
WSP_RuF_Abrechnungssystem
WSP_RuF_Entwicklung_und_Produktion
WSP_RuF_Integration
WSP_RuF_Interoperabilität
WSP_RuF_Stromnetz
WSP_RuF_TechnischesPersonal
WSP_RuF_UpgradefähigkeitLS
WSP_RuF_Zugangstechnik
WIRTSCHAFTLICHKEIT
WSP_WI_BusinessCase
WSP_WI_Einnahmen
WSP_WI_FahrprofilKunde
WSP_WI_Kosten
WSP_WI_Ladedauer
WSP_WI_Ladevorgänge
WSP_WI_Mehrwertdienste
WSP_WI_Standort
WSP_WI_Subvention
ZUKUNFT
WSP_Zukunft_2020
WSP_Zukunft_Abrechnung
WSP_Zukunft_Architektur
WSP_Zukunft_Authentifizierung
WSP_Zukunft_Batteriekapazität
WSP_Zukunft_Batteriekosten
WSP_Zukunft_BusinessCase
WSP_Zukunft_DownloadsUpdates
WSP_Zukunft_Endkunde
WSP_Zukunft_Fahrzeugkosten
WSP_Zukunft_Fahrzeugvernetzung
WSP_Zukunft_Fahrzeugzulassungen
WSP_Zukunft_Konkurrenz
WSP_Zukunft_Kosten
WSP_Zukunft_Ladeangebot
WSP_Zukunft_Ladekarte
WSP_Zukunft_Ladeleistung
WSP_Zukunft_Mehrwertdienste
WSP_Zukunft_Mobilitätsverhalten
WSP_Zukunft_MR_VirtuellerCPO
WSP_Zukunft_Netzbedingungen
WSP_Zukunft_Rahmenbedingungen
WSP_Zukunft_Reichweite
WSP_Zukunft_ReservierungLadestation
WSP_Zukunft_Rollenbesetzung
WSP_Zukunft_Subventionen
WSP_Zukunft_Verbreitung

Level 4 Code Hierarchy: Aussagen zum individuellen Geschäftsmodell einer Firma (IGM)

AKTIVITAET
IGM_Akt_AuffindbarkeitSicherstellen
IGM_Akt_BackendsystemAnbinden
IGM_Akt_Beraten
IGM_Akt_DatenAustauschen
IGM_Akt_EFahrzeugeBereitstellen
IGM_Akt_EFahrzeugeVerkaufen
IGM_Akt_EndkundenmanagementDurchführen
IGM_Akt_FahrverhaltenAnalysieren
IGM_Akt_FinancialClearingAnbieten
IGM_Akt_FörderprojekteDurchführen
IGM_Akt_ForschenUndEntwickeln
IGM_Akt_GenehmigungEinholen
IGM_Akt_GesamtverantwortungTragen
IGM_Akt_GrünstromAnbieten
IGM_Akt_HotlineBetreiben
IGM_Akt_InfrastrukturtypAuswählen
IGM_Akt_Investieren
IGM_Akt_ITSystemeBetreiben
IGM_Akt_Koordinieren
IGM_Akt_LabortestDurchführen
IGM_Akt_LadekartenAnbieten
IGM_Akt_LadeortBetriebswirtschaftlichBewerten
IGM_Akt_LadestationAbnehmen
IGM_Akt_LadestationenProduzieren
IGM_Akt_LadestationenWarten
IGM_Akt_LadestationInbetriebnehmen
IGM_Akt_LadestationInstallieren
IGM_Akt_LadestationManagen
IGM_Akt_LadestationRemoteÜberwachen
IGM_Akt_LadestationReparieren
IGM_Akt_LAdevorgängeAbrechnen
IGM_Akt_LobbyingDurchführen
IGM_Akt_MitarbeiterkonditionenAnbieten
IGM_Akt_NetzanbindungBewerten
IGM_Akt_NetzanschlussDurchführen
IGM_Akt_PartnerschaftenAufbauen
IGM_Akt_Projektieren
IGM_Akt_RahmenvertragErstellen
IGM_Akt_RoamingplattformAnbinden
IGM_Akt_RoamingplattformBetreiben
IGM_Akt_SchnellladeinfrastrukturBetreiben
IGM_Akt_SchnellladenAnbieten
IGM_Akt_SchnellladestationenVermitteln
IGM_Akt_StandortAuswählen
IGM_Akt_StandortBewerten
IGM_Akt_StandortDefinieren
IGM_Akt_StandortSuchen
IGM_Akt_TarifinformationenBereitstellen
IGM_Akt_TechnikOptimieren
IGM_Akt_TechnischenServiceDurchführen
IGM_Akt_TiefbauDurchführen
IGM_Akt_TiefbauPlanen
IGM_Akt_VerbrauchAnalysieren
IGM_Akt_WerbemittelVerkaufen
IGM_Akt_ZugangInfrastrukturErmöglichen
ARCHITEKTUR
IGM_Architektur_Abrechnung
IGM_Architektur_Authentifizierung
IGM_Architektur_Backend
IGM_Architektur_Endkundenmanagement
IGM_Architektur_Fahrzeuginformation
IGM_Architektur_Ladestation
IGM_Architektur_Ladestationsmanagement
IGM_Architektur_PLC
IGM_Architektur_Roaminganschluss
IGM_Architektur_Standards
KONKURRENZ
IGM_Konk_EMP
IGM_Konk_Investor
IGM_Konk_ITBetreiber
IGM_Konk_Ladestationsbetreiber
IGM_Konk_Ladestationshersteller
KOORDINATION
IGM_Koor_Dienstleister
IGM_Koor_Komplexität
IGM_Koor_Vertragsbeziehung
KUNDE
IGM_Kunde_AnwendungsfallSchnellladen
IGM_Kunde_CPO
IGM_Kunde_EMP
IGM_Kunde_Endkunde
IGM_Kunde_Fahrverhalten
IGM_Kunde_Investor
IGM_Kunde_Kanäle
IGM_Kunde_Ladestationshersteller
IGM_Kunde_Ladeverhalten
IGM_Kunde_NutzungLadezeit
LEISTUNGSANGEBOT
IGM_LA_Abrechnung
IGM_LA_Beratung
IGM_LA_BetriebSchnellladeinfrastruktur
IGM_LA_CallCenter
IGM_LA_CrossSelling
IGM_LA_Endkundenmanagement
IGM_LA_EndkundenreichweiteErhöhen
IGM_LA_ErhöhungLadestationsanzahl
IGM_LA_Flottenmonitoring
IGM_LA_Installation
IGM_LA_Interface
IGM_LA_Komplettangebot
IGM_LA_Konformitätszertifikat

IGM_LA_Ladestandort
IGM_LA_Ladestationen
IGM_LA_Ladestationsmanagement
IGM_LA_Mobilität
IGM_LA_Netzwerk
IGM_LA_Rahmenverträge
IGM_LA_RoamingAnbindung
IGM_LA_SchnellladefähigeFahrzeuge
IGM_LA_Schnellladen
IGM_LA_Strom
IGM_LA_Wartung
IGM_LA_WhiteLabeling
IGM_LA_ZugangLadestationen
MOTIVATION
IGM_Mot_Außenwirkung
IGM_Mot_BedeutsamkeitGeschäftsfeld
IGM_Mot_BusinessCase
IGM_Mot_Enabler
IGM_Mot_Pilotierung
IGM_Mot_Politisch
IGM_Mot_Synergieeffekte
MARKTROLLE
IGM_MR_AufbauOrganisator
IGM_MR_Automobilhersteller
IGM_MR_CPO
IGM_MR_CrossSeller
IGM_MR_EMP
IGM_MR_Investor
IGM_MR_ITBetreiber_Ladestationsbetreiber
IGM_MR_Ladestationshersteller
IGM_MR_Roamingplattform
IGM_MR_Standortbereitsteller
IGM_MR_Stromlieferant
IGM_MR_TechnischerBetreiber
IGM_MR_VertriebLadestationen
NETZWERK UND PARTNER
IGM_NuP_AufbauOrganisator
IGM_NuP_Automobilhersteller
IGM_NuP_BauunternehmerInstallation
IGM_NuP_Behörde
IGM_NuP_CallCenter
IGM_NuP_CPO
IGM_NuP_EMP
IGM_NuP_Investor
IGM_NuP_ITBetreiber_Endkundenmanagement
IGM_NuP_ITBetreiber_Ladestationsmanagement
IGM_NuP_ITBetreiber_Roamingplattform
IGM_NuP_Kooperation
IGM_NuP_Ladestationshersteller
IGM_NuP_Roamingplattform
IGM_NuP_Standortbereitsteller
IGM_NuP_Stromlieferant
IGM_NuP_TechnischerBetreiber
IGM_NuP_Vertrieb
IGM_NuP_Wertbeitrag
IGM_NuP_Zahlungssystemhersteller
RESSOURCEN UND FAEHIGKEITEN
IGM_RuF_App
IGM_RuF_Außendienst
IGM_RuF_BetriebswirtschaftlichesKnowHow
IGM_RuF_Elektrotechnik
IGM_RuF_Entwicklung_und_Produktion
IGM_RuF_Integration
IGM_RuF_ITBackend
IGM_RuF_Netzwerkaufbau
IGM_RuF_Rahmenvertrag
IGM_RuF_Stromnetze
IGM_RuF_Vertriebsmitarbeiter
WIRTSCHAFTLICHKEIT
IGM_WI_Abrechnung
IGM_WI_BusinessCase
IGM_WI_Einnahmen
IGM_WI_Kosten
IGM_WI_Ladevorgänge
IGM_WI_Mehtwertdienste
IGM_WI_Nutzung_Ladezeit
IGM_WI_Standort
IGM_WI_Subvention
ZUKUNFT
IGM_Zukunft_Abrechnung
IGM_Zukunft_AnbindungRoamingplattform
IGM_Zukunft_BedeutungGeschäftsfeld
IGM_Zukunft_BusinessCase
IGM_Zukunft_Kanäle
IGM_Zukunft_Konkurrenz
IGM_Zukunft_Kosten
IGM_Zukunft_Ladeleistung
IGM_Zukunft_Mehrwertdienste
IGM_Zukunft_Produkte
IGM_Zukunft_ZugangLadeinfrastruktur

Ontology elements for the domain of fast charging infrastructure in Germany:

Roles (alphabetic order) - Content derived from expert interviews

Name of Role	**Access Technology Provider**
Description	Role provides access technology like RFID cards and RFID readers, Apps and QR-Codes, etc. to EMPs and the infrastructure manufacturers, thereby ensuring its compatibility.
Example	BMW offers a ChargeNow App which enables its customers to read the QR-Codes on charging stations. If the customer is allowed to charge at the station, the authentication process will succeed and the EV- User can start charging.
Actor	Service Industry, OEMs
Target Role	false
Received Value Proposition from Offering Role	
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ WORKING ACCESS TECHNOLOGIES to EMP ▪ ACCESS TECHNOLOGIES FOR CS to CHARGING STATION MANUFACTURER
Expected Value to Target Role	

Name of Role	**Call Center**
Description	Role offers (white label) call center services to EMPs and CPOs
Example	iPremium Service München GmbH operates the ChargeNow Hotline
Actor	Service Industry
Target Role	false
Received Value Proposition from Offering Role	
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ HOTLINE FOR EV- USERS AND EMPS to CPO ▪ HOTLINE FOR EV- USERS to EMP
Expected Value to Target Role	

Name of Role	**Charge Point Operator**
Description	Role is responsible for the correct functionality of the fast charging infrastructure. Thereby the role is mainly coordinating Value Propositions of other Roles (Energy Supplier, Technical Operator, IT-Operator CS Management, Roaming Platform, Call Center). By ensuring the accessibility (incl. authentication) to the infrastructure, CPO enables the role EMP to offer access to the infrastructure to EV- Users.
Example	BMW acts as a CPO at the 'Niederlassungen'. BMW organizes and is responsible for the a correctly working infrastructure and has to ensure that customers of EMPs can authenticate and charge at the fast charging infrastructure.
Actor	OEM, (public) Utilities, Service Industry
Target Role	True
Received Value Proposition from Offering Role	▪ HOTLINE FOR EV- USERS AND EMPS from CALL CENTER ▪ HIGH REACH OF CUSTOMERS FOR LOW TRANSACTION COSTS from ROAMING PLATFORM ▪ CS MANAGEMENT from IT OPERATOR CS MANAGEMENT ▪ MAINTENANCE AND REPAIR from TECHNICAL OPERATOR ▪ ENERGY from ENERGY SUPPLIER
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ WORKING INFRASTRUCTURE FOR EV- USERS to INVESTOR ▪ ACCESS TO CS to ELECTRO MOBILITY PROVIDER
Expected Value to Target Role	

Name of Role	**Charging Station Manufacturer**
Description	Role develops and produces fast charging stations in accordance with international standards and known use-cases for fast charging. Additionally the roles is responsible that the charging station is technically enabled to be connected to management systems and has the necessary authentication methods implemented.
Example	Efacec produces a number of charging stations for specific use cases and ensures that these chargers are in accordance with the international standards so that interoperability is guaranteed.
Actor	Charging Station Manufacturers
Target Role	true
Received Value Proposition from Offering Role	▪ DECLARATION OF CONFORMITY FOR FAST CHARGING STATIONS from ROAMING PLATFORM ▪ ACCESS TECHNOLOGIES FOR CS from ACCESS TECHNOLOGY PROVIDER
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ FAST CHARGING STATIONS to CHARGING STATION SELLER
Expected Value to Target Role	

Name of Role	**Charging Station Seller**
Description	Role offers appropriate charging stations for specific locations. Thereby the role conducts analysis and consults the setup organizer to allow an informed decision on the kind of infrastructure which is to be installed
Example	Efacec has a number of charging stations for specific use cases. Efacec consults the setup organizer on the potentials of locations, fast chargers… to enable the customer to make an informed decision
Actor	Utilites, Charging Station Manufacturers
Target Role	true
Received Value Proposition from Offering Role	FAST CHARGING STATIONS from CHARGING STATION MANUFACTURER
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ APPROPRIATE INFRASTRUCTURE to SETUP ORGANIZER
Expected Value to Target Role	

Name of Role	**Cross Seller**
Description	Role offers shopping opportunities during the 30 minutes fast charging process. This shopping generates revenue. Parts of the corresponding earnings are being transferred to the investor role
Example	FASTNED in Holland offers drinks and foods via vending machines at the fast charging station. The revenue generated via these vending machines supports the infrastructure business case.
Actor	Malls, Supermarkets, Cafes, others
Target Role	False
Received Value Proposition from Offering Role	
Received Value	
Offering Role	true
Offered Value Proposition to Role	▪ SHOPPING OPPORTUNITIES to EV- USER ▪ CROSS FINANCING to INVESTOR
Expected Value to Target Role	

Name of Role	**Electric Mobility Provider (EMP)**
Description	Role offers easy access to public fast charging infrastructure and payment of the corresponding fast charging events
Example	BMW offers the product ChargeNow which allows its customers to access charging stations from many different investors and charge point operators. ChargeNow customers can use an app or an RFID card to access the infrastructure and receive a bill from BMW by the end of each month.
Actor	OEMs, public utilities,
Target Role	True
Received Value Proposition from Offering Role	▪ WORKING ACCESS TECHNOLOGIES from ACCESS TECHNOLOGY PROVIDER ▪ CUSTOMER MANAGEMENT from IT OPERATOR EV- USER MANAGEMENT ▪ HOTLINE for EV- USERS from CALL CENTER ▪ ACCESS TO CS from CHARGE POINT OPERATOR ▪ HIGH NUMBER OF CS FOR LOW TRANSACTION COSTS from ROAMING PLATFORM
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ CUSTOMER-FRIENDLY ACCESS TO CS to EV- USER
Expected Value to Target Role	

Name of Role	**Energy Supplier**
Description	Role provides energy to the fast charging station. Therefore it offers the installation of the initial power supply and also the energy transfer during operations
Example	EnBW offer the appropriate power supply for the installation of fast charging infrastructure. During the operations EnBW supplies the energy transferred from the fast charging station to the EV
Actor	utilities
Target Role	false
Received Value Proposition from Offering Role	
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ ENERGY to CHARGE POINT OPERATOR ▪ POWER SUPPLY to SETUP ORGANIZER
Expected Value to Target Role	

Name of Role	**EV- Manufacturer**
Description	Role offers Electric Vehicles which are capable of charging at CCS-fast charging infrastructure.
Example	BMW produces the CCS-fast charging compatible i3 and offers it to customers
Actor	OEMs (automotive manufacturer)
Target Role	False
Received Value Proposition from Offering Role	
Received Value	
Offering Role	true
Offered Value Proposition to Role	CCS READINESS OF EVS to EV- USER
Expected Value to Target Role	

Name of Role	**EV- User**
Description	Role drives Electric Vehicles, uses fast charging infrastructure and takes up additional offers during the charging process. Role pays for the charging event.
Example	Mrs. Smith drives a CCS-fast charging compatible i3 and charges her car at the CCS DC charging station in front of BMW Welt. During the charging time Mrs. Smith enjoys a coffee at BMW Welt and has a look at the newest innovation by BMW
Actor	Private individuals, Car-Sharing-Users, Car-Fleet companies
Target Role	True
Received Value Proposition from Offering Role	▪ CCS READINESS OF EVS from EV MANUFACTURER ▪ CUSTOMER-FRIENDLY ACCESS TO CS from EMP ▪ CUSTOMER-FRIENDLY FAST CHARGING from INVESTOR ▪ SHOPPING OPPORTUNITIES from CROSS SELLER
Received Value	
Offering Role	false
Offered Value Proposition to Role	
Expected Value to Target Role	

Name of Role	**Government**
Description	Role supports the installation of fast charging infrastructure by offering subsidies to Investor. Additionally, but outside the scope of this visualization, the role government is defining the legal framework including rules and regulations for this domain
Example	Bundesministerium für Wirtschaft und Energie (BMWi) offers subsidies in the government funded project SLAM
Actor	Governmental Ministry
Target Role	false
Received Value Proposition from Offering Role	
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ SUBSIDIES to INVESTOR
Expected Value to Target Role	

Name of Role	**Installer**
Description	Role conducts all civil and electrical engineering work to install fast charging stations.
Example	Whoever does the civil and electrical engineering to connect the fast charging station to the closest power supply.
Actor	Civil Engineers
Target Role	false
Received Value Proposition from Offering Role	
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ INSTALLED INFRASTRUCTURE to SETUP ORGANIZER
Expected Value to Target Role	

Name of Role	**Investor**
Description	Role invests in fast charging infrastructure and thereby covers most of the associated risk. Investor aims at generating a viable business by offering fast-charging towards EV- Users. Investor is, from the EV- User-perspective, responsible for the correct functionality of the fast charging process.
Example	BMW invests in fast charging infrastructure at its "Niederlassungen" to offer it to EV- Users. Thereby a company organizes the installation and another one is responsible of operations
Actor	(public) Utilities, OEMs, Municipalities
Target Role	True
Received Value Proposition from Offering Role	▪ WORKING INFRASTRUCTURE FOR EV- USERS from CHARGE POINT OPERATOR ▪ TURNKEY SOLUTION FOR CS from SETUP ORGANIZER ▪ SUBSIDIES from GOVERNMENT ▪ CROSS FINANCING from CROSS SELLER
Received Value	
Offering Role	True
Offered Value Proposition to Role	CUSTOMER-FRIENDLY FAST CHARGING to EV- USER
Expected Value to Target Role	

Name of Role	**IT Operator CS Management**
Description	Role offers to conduct the operative management of charging stations. This includes the necessary backend solutions for authentication and load management.
Example	Allego provides the service of CS management including the necessary backend solutions for authentication and load management to BMW.
Actor	Service Industry
Target Role	true
Received Value Proposition from Offering Role	▪ DECLARATION OF CONFORMITY FOR CS MANAGEMENT from ROAMING PLATFORM
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ CS MANAGEMENT to CPO
Expected Value to Target Role	

Name of Role	**IT Operator EV- User Management**
Description	Role offers to conduct the operative customer management. The role is responsible for all data management concerning the customers, including contract management and billing based on charge detail records.
Example	Company X offers the service customer management including contract management and billing based on CDRs to ChargeNow. Its IT backend is connected with the BMW IT Backend.
Actor	Service Industry
Target Role	true
Received Value Proposition from Offering Role	▪ DECLARATION OF CONFORMITY FOR EV- USER MANAGEMENT from ROAMING PLATFORM
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ CUSTOMER MANAGEMENT to EMP
Expected Value to Target Role	

Name of Role	**IT Operator Roaming Platform**
Description	Role offers the operative management of the IT Backend of Roaming Platforms. IT conducts all the necessary operations to allow data transfer and other services of the Roaming Platform.
Example	Bosch offers the operations of the IT-Platform to Hubject.
Actor	IT Service Industry
Target Role	false
Received Value Proposition from Offering Role	
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ WORKING ROAMING PLATFORM to ROAMING PLATFORM
Expected Value to Target Role	

Name of Role	**Location Provider**
Description	Role provides locations for the setup and installation of fast charging infrastructure.
Example	BMW Welt offers a charging location right in front of the building with easy access and great visibility. Additionally many potential customers are in the area and have meetings close by.
Actor	Companies, Malls, Super Markets
Target Role	false
Received Value Proposition from Offering Role	
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ ATTRACTIVE CHARGING LOCATIONS to SETUP ORGANIZER
Expected Value to Target Role	

Name of Role	**Public Authorities**
Description	Role offers all necessary Licenses and Permissions to install and operate fast charging stations at (semi) public locations.
Example	Tiefbauamt grants the permission to install a fast charging station
Actor	utilities
Target Role	false
Received Value Proposition from Offering Role	
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ LICENSES AND PERMISSIONS to SETUP ORGANIZER
Expected Value to Target Role	

Name of Role	**Roaming Platform**
Description	Role enables EMPs and CPOs to improve their corresponding value propositions by offering a platform to exchange data about charging stations and charging events. Thereby the role sets an operating standard to which charging stations and IT-backends have to comply with.
Example	Hubject is a plattform which enables German CPOs and EMPs to be part of a network. CPOs can offer the charging stations to all EMPs and their customers, thereby creating a higher reach. EMPs can improve their Value Proposition by offering access to all charging stations in the Hubject network. The interoperability is ensured by the OICP standard.
Actor	Service Industry
Target Role	true
Received Value Proposition from Offering Role	▪ WORKING ROAMING PLATFORM from IT OPERATOR ROAMING PLATFORM
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ DECLARATION OF CONFORMITY FOR EV- USER MANAGEMENT to IT-OPERATOR OF EV- User MANAGEMENT ▪ DECLARATION OF CONFORMITY FOR CS MANAGEMENT to IT-OPERATOR CS MANAGEMENT ▪ DECLARATION OF CONFORMITY FOR FAST CHARGING STATIONS to CHARGING STATION MANUFACTURER ▪ HIGH NUMBER OF CS FOR LOW TRANSACTION COSTS to EMP ▪ HIGH REACH OF CUSTOMERS FOR LOW TRANSACTION COSTS to CPO
Expected Value to Target Role	

Name of Role	**Setup Organizer**
Description	Role organizes the installation process by coordinating Value Propositions of other Roles (Location Provider, Public Authorities, Installer, Charging Station Seller, Energy Supplier).
Example	DG Verlag organizes the installation of fast charging infrastructure for Volksbanken und Raiffeisenbanken
Actor	(public) Utilities, Service Industry
Target Role	True
Received Value Proposition from Offering Role	▪ ATTRACTIVE CHARGING LOCATIONS from LOCATION PROVIDER ▪ LICENSES AND PERMISSIONS from PUBLIC AUTHORITIES ▪ APPROPRIATE INFRASTRUCTURE from SELLER CHARGING STATION ▪ INSTALLED INFRASTRUCTURE from INSTALLER ▪ POWER SUPPLY from ENERGY SUPPLIER
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ TURNKEY SOLUTION FOR CS to INVESTOR
Expected Value to Target Role	

Name of Role	**Technical Operator**
Description	Role ensures the technical operability and functionality of charging stations. The role is responsible for conducting maintenance of charging stations as well as repairs in case of failure.
Example	ABB offers, on top of warranty, a service contract for their charging stations
Actor	EV station manufacturer, Electricians
Target Role	false
Received Value Proposition from Offering Role	
Received Value	
Offering Role	True
Offered Value Proposition to Role	▪ MAINTENANCE AND REPAIR to CPO
Expected Value to Target Role	

Ontology elements for the domain of fast charging infrastructure in Germany:

Value Propositions (alphabetic order) - Content derived from expert interviews

Name of Value Proposition	**Access Technologies for CS**
Description	Access technologies like RFID card reader or QR tags that enable CPO and EMP to grant access to the charging station to individuals by checking the validity of an authorization.
Example	Company X offers QR tags which allow, combined with underlying IT systems, to check the authorization of EV- Users on charging stations. A customer with a ChargeNow App can use the integrated QR scanner. The underlying protocols and contracts enable the EV- User to charge at charging stations which are part of the ChargeNow network
Value Proposition Components	
Target Role	CHARGING STATION MANUFACTURER
Value for Target Role	
Offering Role	ACCESS TECHNOLOGY PROVIDER
Value for Offering Role	
Activities	– Consulting – Laboratory tests – Manuacturing of White Label Products – Research and Development

Name of Value Proposition	**Access to CS**
Description	Customers of EMPs can access the charging stations which are operated by a CPO. Therefore the CPO guarantees a working authentication via the EMP-authentication-medium and ensures the continuing interoperability of the charging station with EVs after an initial testing.
Example	Allego as the CPO of BMW charging station ensures the correct functionality of the charging stations and makes sure that the agreed authentication methods work with a high reliability, so that customers of EMPs can use the infrastructure.
Value Proposition Components	
Target Role	ELECTRO MOBILITY PROVIDER
Value for Target Role	
Offering Role	CHARGE POINT OPERATOR
Value for Offering Role	
Activities	- Billing - Coordination of network - Develop master agreement - Ensure findability of CS - Manage and operate CS - Provide POI data including prices

Name of Value Proposition	**Appropriate Infrastructure**
Description	The appropriate infrastructure is provided on time. Thereby the Charging Station Seller consults the setup organizer towards what charging station is suited best for a specific location, including number of plugs, necessary connection power and potential restrictions of locations.
Example	Efacec has a portfolio of charging stations for different use cases. As part of the sales process, Efacec talks to the setup organizer about wishes, potentials and restrictions and provides an offer which suites best.
Value Proposition Components	
Target Role	LOCATION PROVIDER
Value for Target Role	
Offering Role	CHARGING STATION SELLER
Value for Offering Role	
Activities	- Assess charging location - Broker CS - Consulting - Partner management

Name of Value Proposition	**Attractive Charging Locations**
Description	Charging location that offer a high frequency of EV user who are willing to charge. Attractiveness is determined by accessibility, offers to use the charging time like shopping, close to planned route (rest stops) and other characteristics that make EV users choose a charging station.
Example	The location BMW Welt in Munich offers a number of valuable characteristics like closeness to many EV- Users, shopping opportunities, easy access and is one of the most frequented fast charging stations in Germany.
Value Proposition Components	
Target Role	LOCATION PROVIDER
Value for Target Role	
Offering Role	SETUP ORGANIZER
Value for Offering Role	
Activities	- Provide Location

Name of Value Proposition	**CCS readiness of EVs**
Description	ElVs are technically ready to perform CCS fast charging events. Therefore the proper equipment is provided and the interoperability between the cars and the infrastructure is ensured.
Example	Mrs. Smith orders an i3 with the fast charging option which is offered by BMW i. Therefore, Mrs Smith is able to conduct fast charging events at fast charging infrastructure
Value Proposition Components	
Target Role	EV- USER
Value for Target Role	
Offering Role	EV MANUFACTURER
Value for Offering Role	
Activities	- Analyze Driving Patterns - Lobbying - Offer Vehicles - Research and development

Name of Value Proposition	**CS Management**
Description	IT systemto manage the charging stations of an Investor. The IT systemprovides management solutions like load balancing or supervision and enables the authentication of EV- Users on charging stations. Information about the charging process can be used to generate Charge Detail Records which are the basis for the subsequent payment by the EMPs.
Example	Allego offers the service of chargepoint management including the necessary backend solutions for authentication and load management to BMW
Value Proposition Components	
Target Role	CPO
Value for Target Role	
Offering Role	IT OPERATOR CS MANAGEMENT
Value for Offering Role	
Activities	- Connect IT Systems - Contract management - Ensure Authentication - Operate IT Systems - Remote Control CS - Remote SW Updates

Name of Value Proposition	**Cross Financing**
Description	Passing on of earnings generated at charging locations due to EV- Users
Example	The additional earnings generated by selling snacks and drinks by using vending machines cross finances the business case of FastNED
Value Proposition Components	
Target Role	INVESTOR
Value for Target Role	
Offering Role	CROSS SELLER
Value for Offering Role	
Activities	- Billing - Contract Management

Name of Value Proposition	**Customer-friendly Access to CS**
Description	EV- Users have access to as many charging stations as possible of different Investors by using only one contract. Charging stations are easy to find, the access is intuitive and charging stations work reliable.
Example	ChargeNow offers access to more than 4000 chargepoints in Germany, all accessible via ChargeNow Card and App. At the end of each months, customers receive a bill about the conducted charging events at (semi) public charging events. To find the charging stations, customers can use apps, websites or the navigation system in their car.
Value Proposition Components	
Target Role	EV- User
Value for Target Role	
Offering Role	ELECTRO MOBILITY PROVIDER
Value for Offering Role	
Activities	- Contract Management - Coordinate partner network - Customer contact - Customer Management - Operate Charging cards and other authentication medium

Name of Value Proposition	**Customer-friendly Fast Charging**
Description	Easy detection, easy access, easy authentication and a fast charging event with maximum loading capacity
Example	Mrs. Smith is in Munich and is looking for a fast charging station. Opening hours and readiness of fast charging station at the BMW Welt are displayed in the i3 navigation system which she uses to navigate her to the station. In addition she gets this information via app. Approaching BMW Welt she easily sees the fast charging station which is located next to the entrance and is visible from the streets. At the charging station, authentication is possible via common mediums (RFID-Card, App). The Charging station is working and she gains more than 100km of range within less than 30 minutes.
Value Proposition Components	▪ CHARGING STATION POI DATA ▪ AUTHENTIFICATION ▪ TECHNICAL READYNESS OF CHARGING STATION ▪ CHARGING SPEED
Target Role	EV- USER
Value for Target Role	
Offering Role	INVESTOR
Value for Offering Role	
Activities	- Coordinate partner network - Enable Access to Charging Station - Invest - Manage - Offer fast charging

Name of Value Proposition	**Customer Management**
Description	Operations of the IT systems for the EV- User management of an EMP´, including Customer Data management and billing
Example	Bill-X offers the service of operating the customer management including billing to ChargeNow/ BMW.
Value Proposition Components	
Target Role	ELECTRO MOBILITY PROVIDER
Value for Target Role	
Offering Role	IT OPERATOR EV- USER MANAGEMENT
Value for Offering Role	
Activities	- Billing - Connect IT Systems - Customer Management - Operate IT Systems

Name of Value Proposition	**Declaration of Conformity for CS Management**
Description	A Certificate or seal that shows that a charging station IT system is compatible with the needs of a charging network. This advertises the IT systems compatibility, offers marketing opportunities and sales channels
Example	Hubject offers the “Certified eRoaming System” seal of approval. This shows that chargepoint management systems have been successfully connected to Hubject’s eRoaming platform after having passed technical tests
Value Proposition Components	
Target Role	IT OPERATOER CS MANAGEMENT
Value for Target Role	
Offering Role	ROAMING PLATFORM
Value for Offering Role	
Activities	- Laboratory tests - Provide Certificate

Name of Value Proposition	**Declaration of Conformity for EV- User Management**
Description	A Certificate or seal that shows that a Customer Relationship Management IT system is compatible with the needs of a charging network. This advertises the IT systems compatibility, offers marketing opportunities and sales channels
Example	Hubject offers the "Certified eRoaming System" seal of approval. This shows that a CRM systems have been successfully connected to Hubject's eRoaming platform after having passed technical tests
Value Proposition Components	
Target Role	IT OPERATOR EV- USER MANAGEMENT
Value for Target Role	
Offering Role	ROAMING PLATFORM
Value for Offering Role	
Activities	- Laboratory tests - Provide Certificate

Name of Value Proposition	**Declaration of Conformity for fast charging stations**
Description	A Certificate or seal that shows that a charging station is compatible with the needs of a charging network. This advertises the charging infrastructure's compatibility, offers marketing opportunities and sales channels
Example	Hubject offers the "eRoaming Technology" seal of approval which shows that a charging stations can be integrated seamlessly into Hubject's eRoaming network
Value Proposition Components	
Target Role	CHARGING STATION MANUFACTURER
Value for Target Role	
Offering Role	ROAMING PLATFORM
Value for Offering Role	
Activities	- Laboratory tests - Provide Certificate

Name of Value Proposition	**Energy**
Description	Energy needed during the charging process is provided
Example	E.On supplies the energy for charging events at the fast charging stations on the A9-DC-Axis
Value Proposition Components	
Target Role	CHARGE POINT OPERATOR
Value for Target Role	
Offering Role	ENERGY SUPPLIER
Value for Offering Role	
Activities	- Billing - Contract management - Ensure availability of capacity - Provide energy

Name of Value Proposition	**Fast Charging Stations**
Description	Provision of fast charging stations which are in accordance to international standards, compatible and interoperable with all EVs that build on the same technology
Example	Efacec has the QC45 in its portfolio, a fast charging station that is compatible with AC-3phase, DC-CCS (Combo) and CHAdeMO
Value Proposition Components	
Target Role	CHARGING STATION SELLER
Value for Target Role	
Offering Role	CHARGING STATION MANUFACTURER
Value for Offering Role	
Activities	- Manufacturing of White Label Products - Production of CS - Provide Software Updates for CS - Research and Development

Name of Value Proposition	**High number of CS for Low Transaction Costs**
Description	Via one API (application programming interface), charging stations of many different CPOs can be accessed by the customers of the EMP
Example	Hubject offers to EMPs the technical and contractual connection to the roaming platform. Via the technical connection, an EMP can get the respective information on the charging stations in the network. Via the standard contract or via individual agreements, EMPs and CPOs can have a contractual relationship which enables the customers of the EMP to charge at the stations of the CPOs. Additionally the charge detail record is provided via the platform which builds the foundation of payments for the charging events.
Value Proposition Components	
Target Role	ELECTRO MOBILITY PROVIDER
Value for Target Role	
Offering Role	ROAMING PLATFORM
Value for Offering Role	
Activities	- Billing - Coordinate - Contract Management - Develop master agreement - Ensure Authentication - Provide POI data

Name of Value Proposition	**High Reach of Customers for Low Transaction Costs**
Description	Via one API (Application programming interface), many different EMPs and their respective customers can get access to charging stations of a CPO and charge their.
Example	Hubject offers to CPOs the technical and contractual connection to the roaming platform. Via the technical connection, all EMPs can get the respective information on the charging station. Via the standard contract or via individual agreements, CPOs and EMPs can have a contractual relationship which enables the customers of the EMPs to charge at the stations of the CPO. Additionally the charge detail record is provided via the platform which builds the foundation of payments for the charging events.
Value Proposition Components	
Target Role	CHARGE POINT OPERATOR
Value for Target Role	
Offering Role	ROAMING PLATFORM
Value for Offering Role	
Activities	- Billing - Coordinate - Contract Management - Develop master agreement - Ensure Authentication

Name of Value Proposition	**Hotline for EV- Users**
Description	In case of questions, orders or complaints, EV- Users might want to call a hotline. This service is provided by the Role, often as a “White-Label” service, so that the caller thinks that she is calling the EMP itself and not some service provider.
Example	iPremium Service München GmbH operates the ChargeNow Hotline
Value Proposition Components	
Target Role	EMP
Value for Target Role	
Offering Role	CALL CENTER
Value for Offering Role	
Activities	- Billing - Operate Hotline - Provide White-Label services

Name of Value Proposition	**Hotline for EV- Users and EMPs**
Description	In case of questions or complaints, EV- Users or EMPs might want to contact the owner (operator) of fast charging infrastructure. This service is provided by the Role, often as a "whitelabel" service, so that the caller thinks that she is calling the CPO- role itself.
Example	iPremium Service München GmbH operates BMW's CPO Hotline
Value Proposition Components	
Target Role	CPO
Value for Target Role	
Offering Role	CALL CENTER
Value for Offering Role	
Activities	- Billing - Operate Hotline - Provide White-Label services

Name of Value Proposition	**Installed Infrastructure**
Description	Fast charging infrastructure is installed on time including all necessary steps of underground work and electrical connection.
Example	Within the government funded project "elektromobilität verbindet" ABB installed the DC-fast charging infrastructure along the German Autobahn A9
Value Proposition Components	
Target Role	SETUP ORGANIZER
Value for Target Role	
Offering Role	INSTALLER
Value for Offering Role	
Activities	- Conduct civil engineering - Install and commission CS - Plan civil engineering

Name of Value Proposition	**Licenses and Permissions**
Description	All Licenses and Permissions that are necessary for the installation and subsequent operations of a fast charging station
Example	Building permission is granted by the Tiefbauamt
Value Proposition Components	
Target Role	SETUP ORGANIZER
Value for Target Role	
Offering Role	PUBLIC AUTHORITIES
Value for Offering Role	
Activities	- Administer Licenses and Permissions - Assess applications

Name of Value Proposition	**Maintenance and Repair**
Description	High level of technical availability of charging stations based on maintenance, remote and onside. Repair in case of malfunction is conducted in accordance to the Service Level Agreement, either remote or onsite, if necessary.
Example	ABB offers, on top of warranty, a service contract for their charging stations
Value Proposition Components	
Target Role	CPO
Value for Target Role	
Offering Role	TECHNICAL OPERATOR
Value for Offering Role	
Activities	- Conduct maintenance of CS - Conduct technical service calls - Repair CS - Update CS software

Name of Value Proposition	**Power Supply**
Description	Provision of a Power Supply with the necessary electric power to enable fast charging events at the planned location
Example	Netzgesellschaft Düsseldorf , responsible for the power supply system in Düsseldorf provides Stadtwerke Düsseldorf, a local CPO, with the necessary electric power to install fast charging infrastructure within its service area.
Value Proposition Components	
Target Role	SETUP ORGANIZER
Value for Target Role	
Offering Role	ENERGY SUPPLIER
Value for Offering Role	
Activities	- Provide power supply

Name of Value Proposition	**Shopping opportunities**
Description	A fast charging event takes up to 30 minutes. During this times, customers have the opportunity to make use of this time by doing shopping of some sort. Examples of this are grocery shopping, having a coffee or other drink or do some cloth shopping nearby
Example	Ingolstadt village offers EV- Users shopping opportunities (cafés, retail stores, food) during the charging event.
Value Proposition Components	
Target Role	EV- USER
Value for Target Role	
Offering Role	CROSS SELLER
Value for Offering Role	
Activities	- Advertising - Procurement - Sales

Name of Value Proposition	**Subsidies**
Description	Governmental subsidies to support the installation of fast charging stations at relevant locations to support e-Mobility
Example	Subsidies of up to 50% for investors in the SLAM project
Value Proposition Components	▪ Direct subsidies ▪ Tax reliefs ▪ Special depreciation
Target Role	INVESTOR
Value for Target Role	
Offering Role	GOVERNMENT
Value for Offering Role	
Activities	- Administer subsidies - Assess application

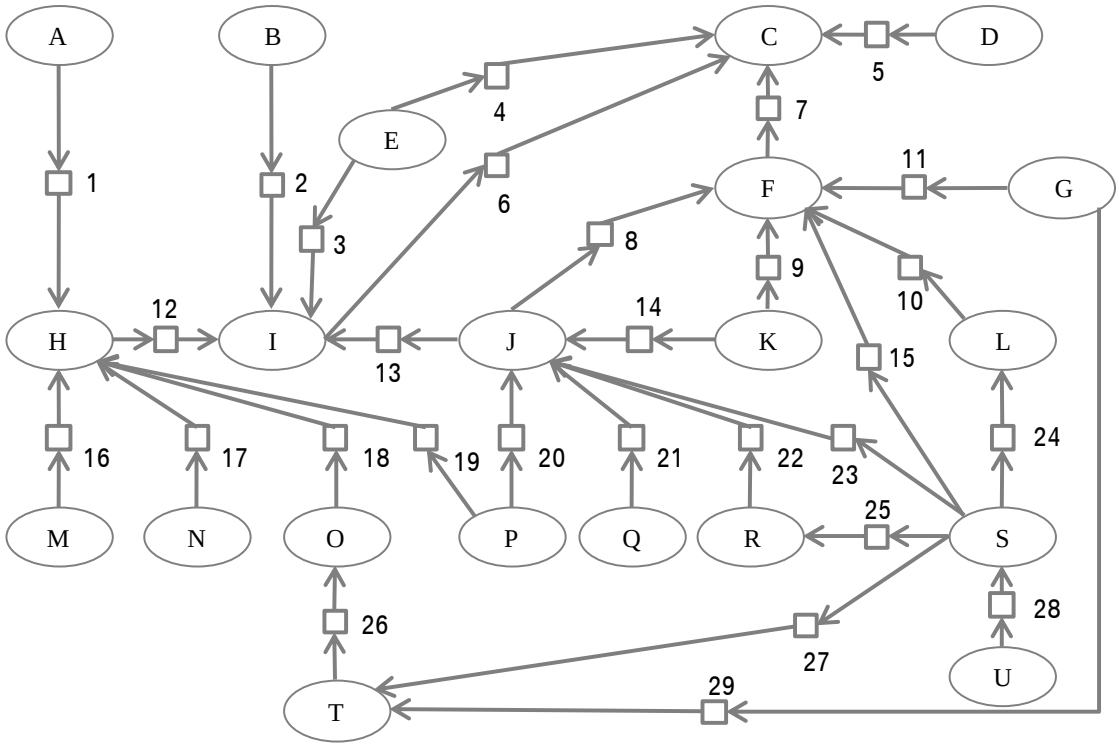
Name of Value Proposition	**Turnkey Solution for CS**
Description	Fully functional, installed infrastructure at a specific charging station including all necessary licenses and permissions will be handed over to INVESTOR
Example	DG Verlag offers to potential investors to organize the installation of charging infrastructure including the organization and supervision of all necessary steps.
Value Proposition Components	
Target Role	INVESTOR
Value for Target Role	
Offering Role	SETUP ORGANIZER
Value for Offering Role	
Activities	- Apply for licenses and permissions - Develop master agreement - Appraisal of CS commission - Appraisal of power supply - Consulting - Coordinate network - Develop partnerships - Financial assessment of charging location - Project management - Select charging location - Search charging location

Name of Value Proposition	**Working Access Technologies**
Description	Access technologies that enable customers of EMPs to get authorization to charge at specific charging locations. Hereby the goal is to ensure technological compatibility between the authentication medium (Card, QR-Reader) and the devices at the charging stations
Example	BMW develops the ChargeNow App which enables customers to use a QR-scanner to authenticate at charging locations in the ChargeNow network. Therefore customers have to put in their ChargeNow contract data and then the authentication process at charging points works automatically after scanning the QR-Code on the charging station
Value Proposition Components	
Target Role	ELECTRO MOBILITY PROVIDER
Value for Target Role	
Offering Role	ACCESS TECHNOLOGY PROVIDER
Value for Offering Role	
Activities	– Consulting – Laboratory tests – Manufacturing of White Label Products – Research and Development

Name of Value Proposition	**Working infrastructure for EV- Users**
Description	Fully operational fast charging infrastructure within the limits of the Service Level Agreements.
Example	Allego is responsible for the operations of BMW (INVESTOR) fast charging infrastructure within the limits of the Service Level Agreement between the two parties.
Value Proposition Components	
Target Role	INVESTOR
Value for Target Role	
Offering Role	CHARGE POINT OPERATOR
Value for Offering Role	
Activities	- Advertising - Billing - Coordinate network - Develop master agreement - Ensure findability of CS - Manage and operate CS

Name of Value Proposition	**Working Roaming Platform**
Description	High level of operational availability of the Roaming platform including operation, maintenance, connection of new EMP- and CPO- backends and further development of the platform itself
Example	Hubject has a supplier for the technical operation of the roaming platform
Value Proposition Components	
Target Role	ROAMING PLATFORM
Value for Target Role	
Offering Role	IT OPERATOR ROAMING PLATFORM
Value for Offering Role	
Activities	- Connect IT Systems - Operate IT Systems

Positioning of the experts' companies and strategic partners in the frame of reference

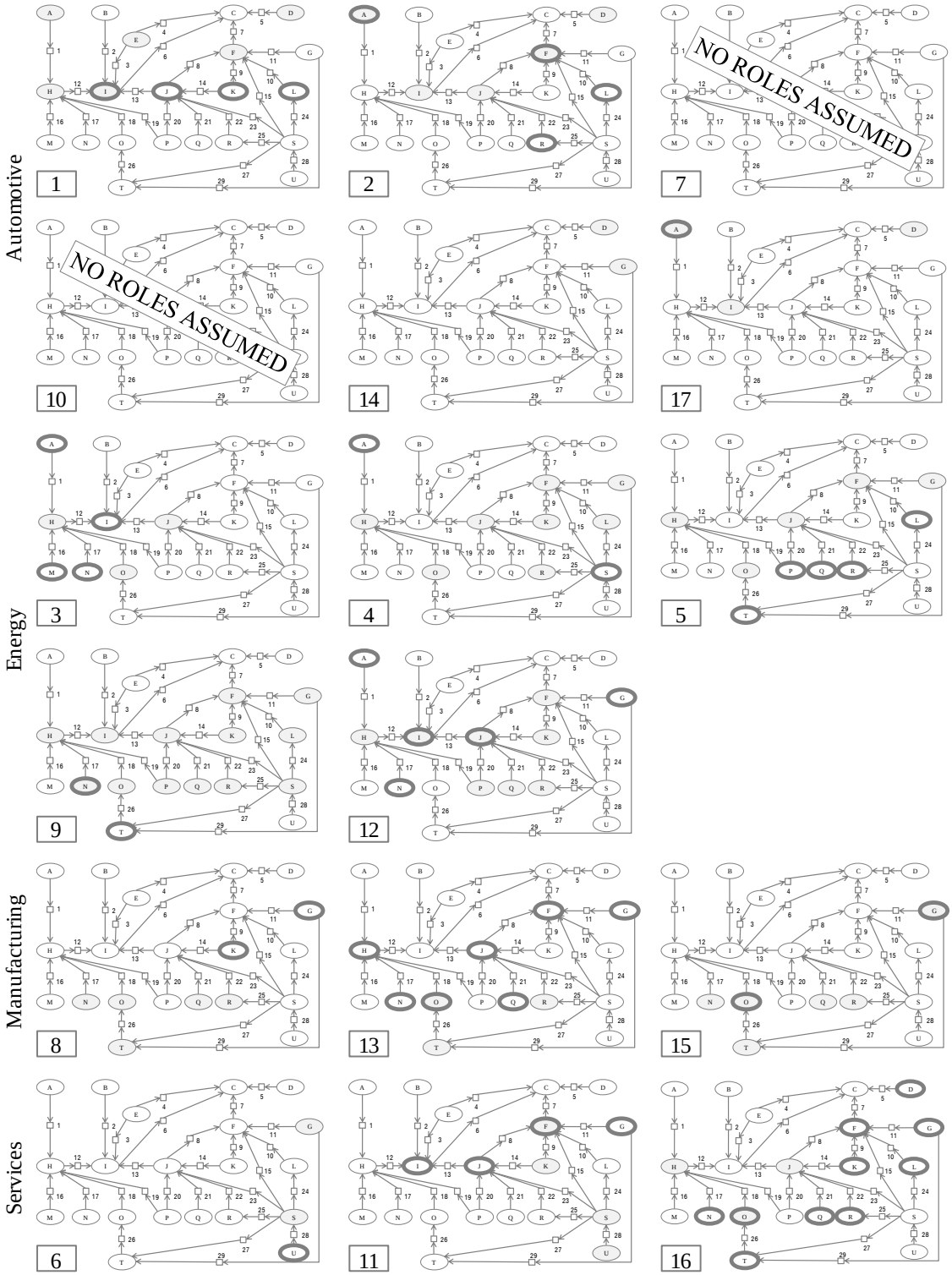


Roles

A) Location Provider
B) Government
C) EV- User
D) EV- Manufacturer
E) Cross Seller
F) Electric Mobility Provider
G) Access Technology Provider
H) Setup Organizer
I) Investor
J) Charge Point Operator
K) Call Center
L) IT Operator EV- User Management
M) Public Authorities
N) Installer
O) Charging Station Seller
P) Energy Supplier
Q) Technical Operator
R) IT Operator CS Management
S) Roaming Platform
T) Charging Station Manufacturer
U) IT Operator Roaming Platform

Value Propositions

1) Attractive Charging Location
2) Subsidies
3) Cross Financing
4) Shopping Opportunities
5) CCS-Readiness of EVs
6) Customer-friendly Fast Charging
7) Customer-friendly Access to CS
8) Access to CS
9) Hotline for EV- Users
10) Customer Management
11) Working Access Technologies
12) Turnkey Solution for CS
13) Working Infrastructure for EV- User
14) Hotline for EV- User and EMPs
15) High Number of CS for Low Transaction Costs
16) Licenses and Permissions
17) Installed Infrastructure
18) Appropriate Infrastructure
19) Power Supply
20) Energy
21) Maintenance and Repair
22) CS Management
23) High Reach of Customers for Low Transaction Cost
24) Declaration of Conformity for EV- User Management
25) Declaration of Conformity for CS Management
26) Fast Charging Stations
27) Declaration of Conformity for Fast Charging Stations
28) Working Roaming Platform
29) Access Technologies for CS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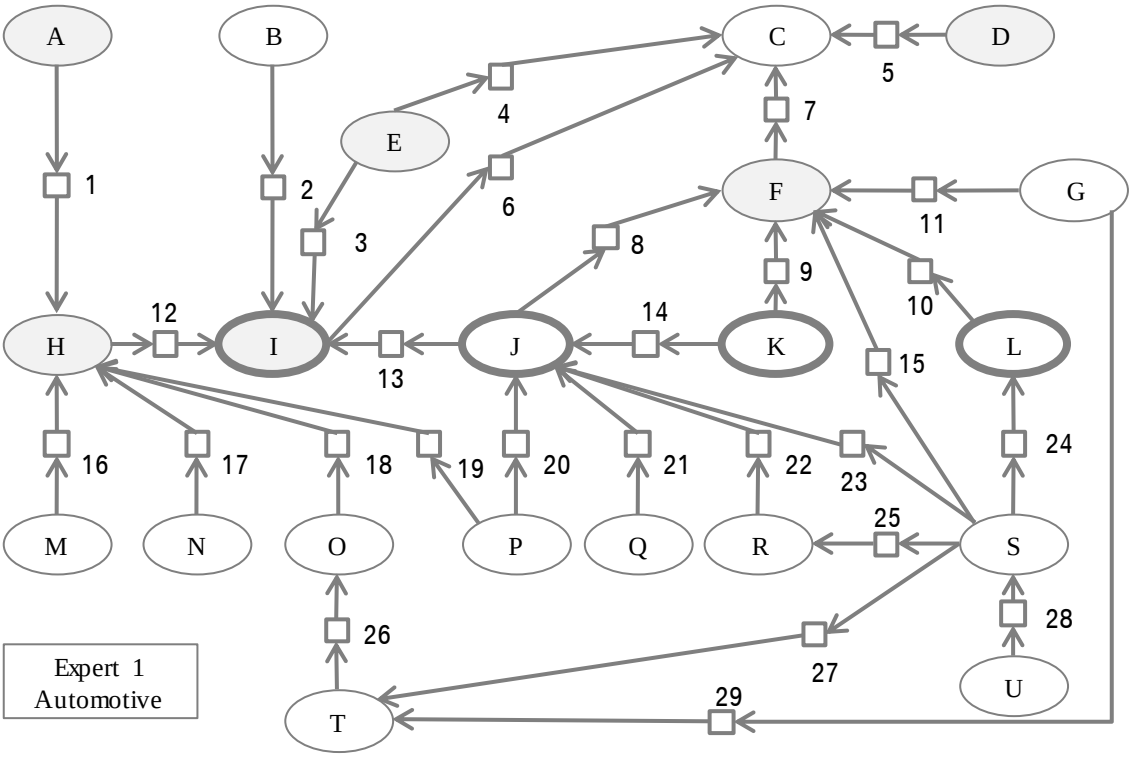
1 Expert No.
Role assumed by: Company Strategic Partner Both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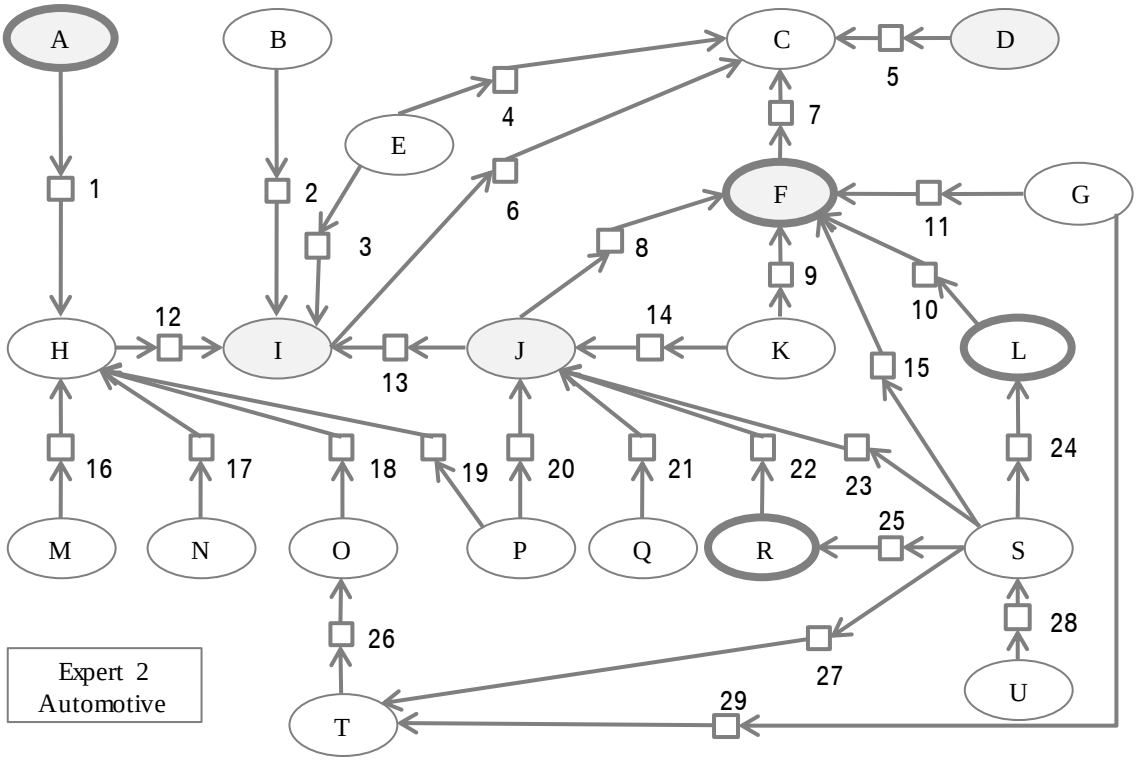
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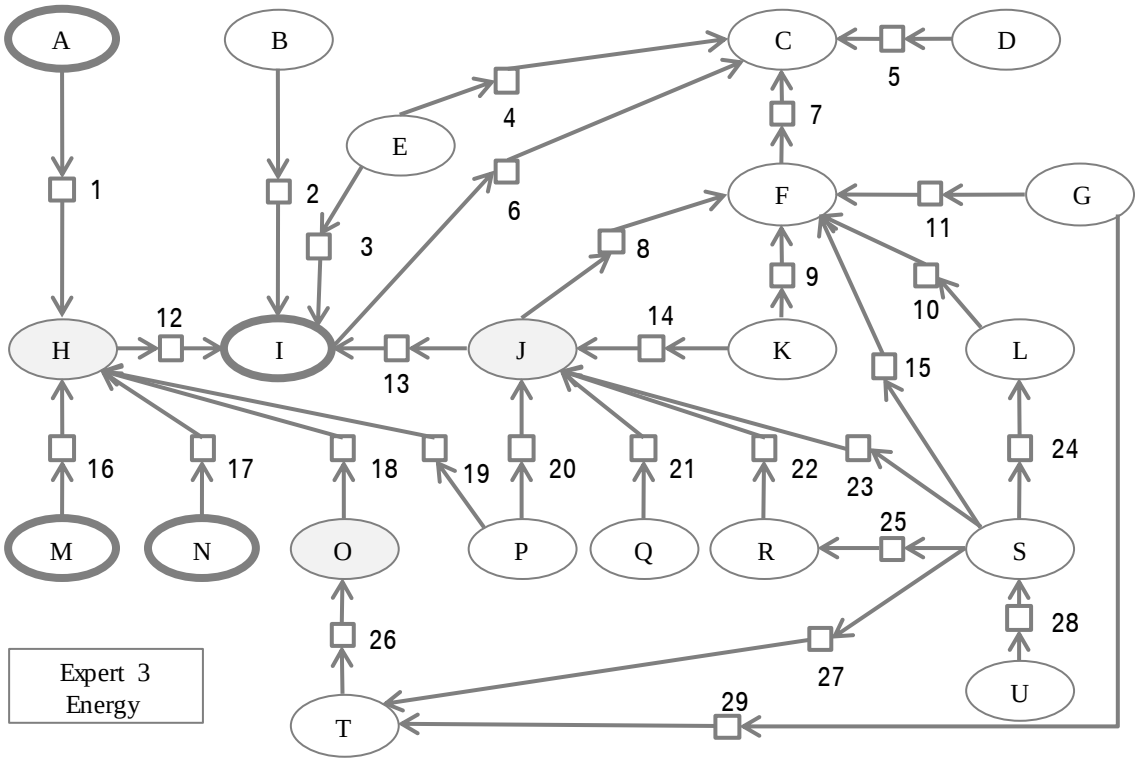
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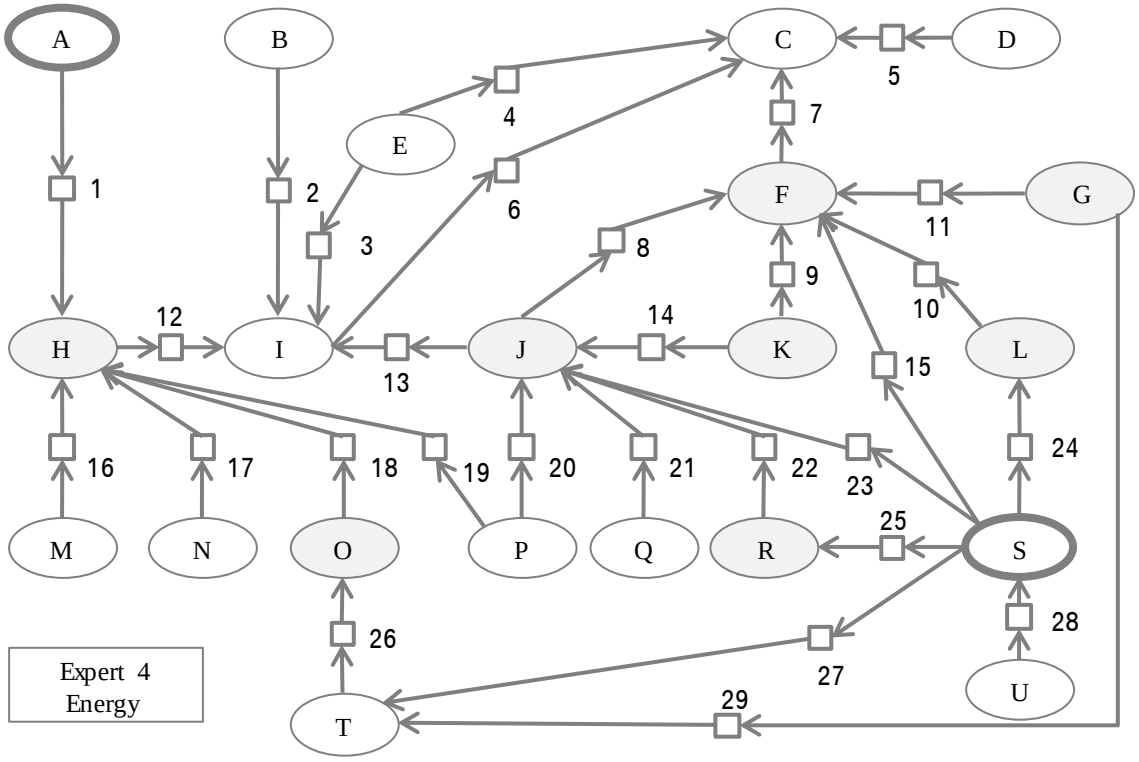
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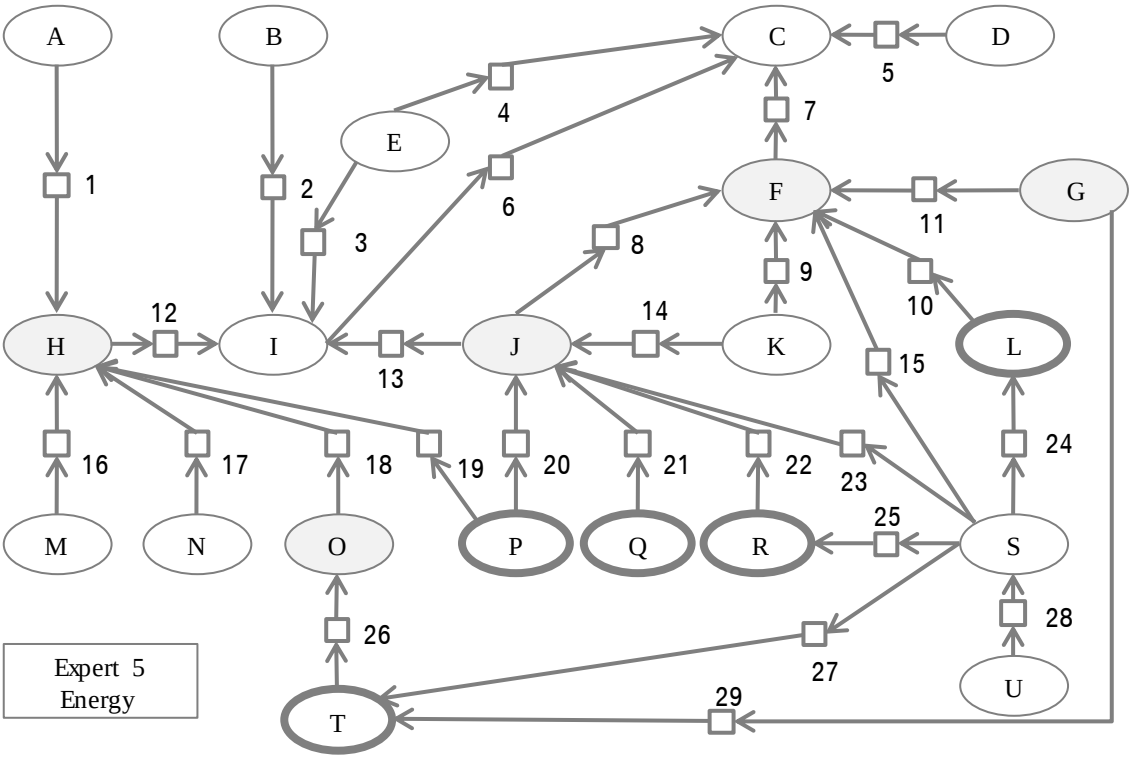
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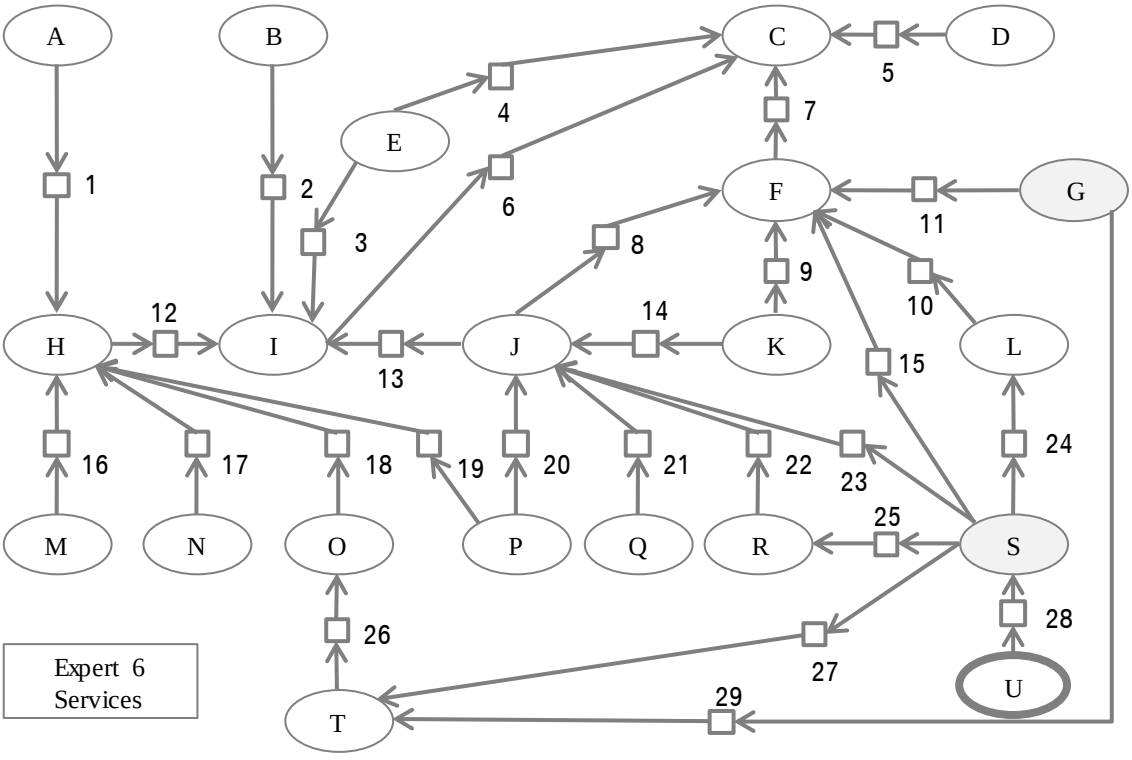
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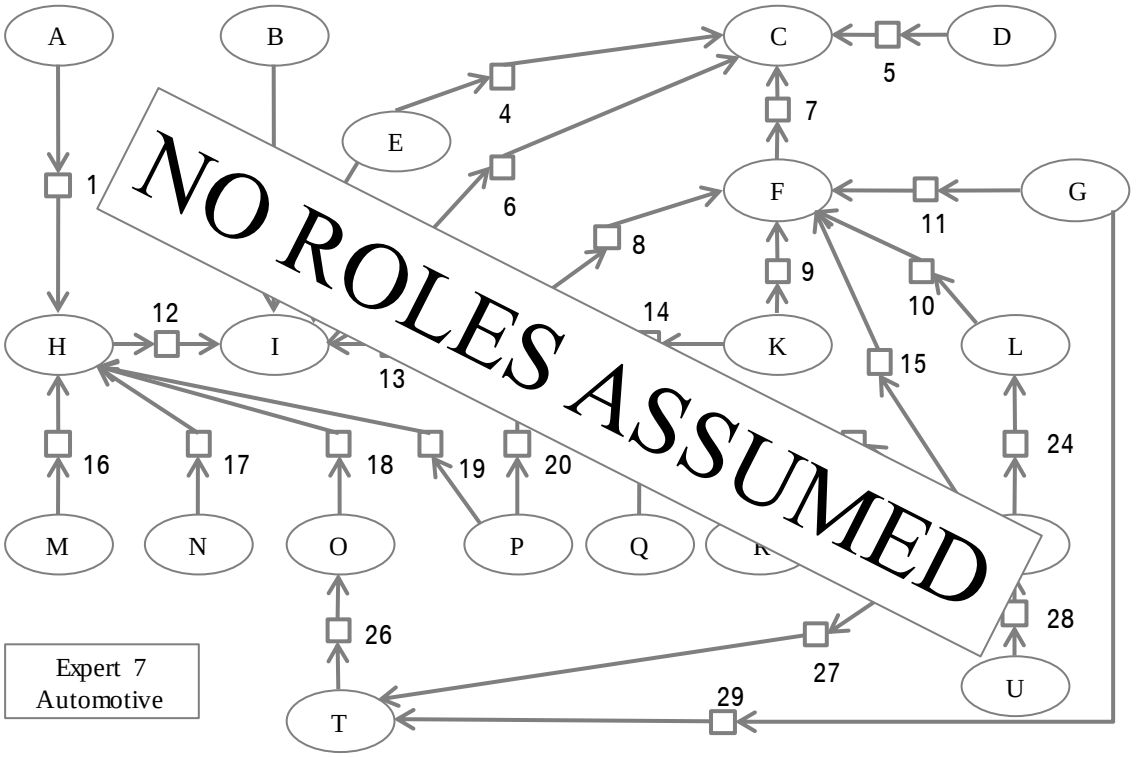
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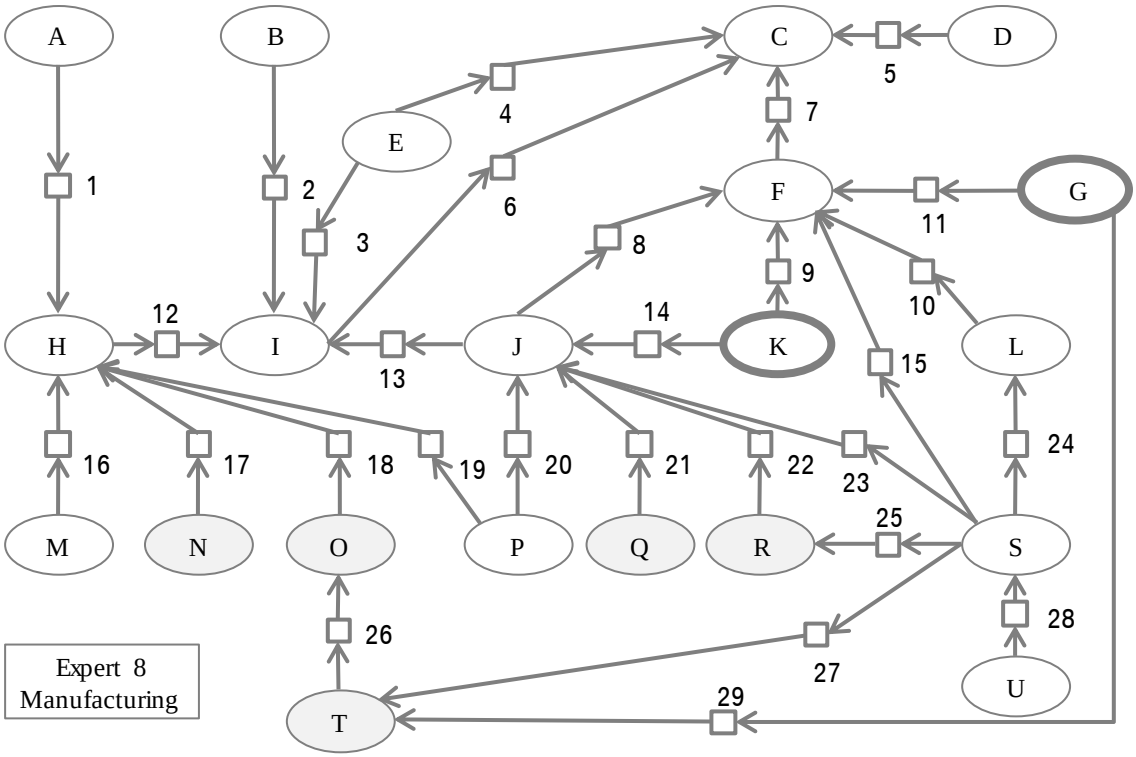
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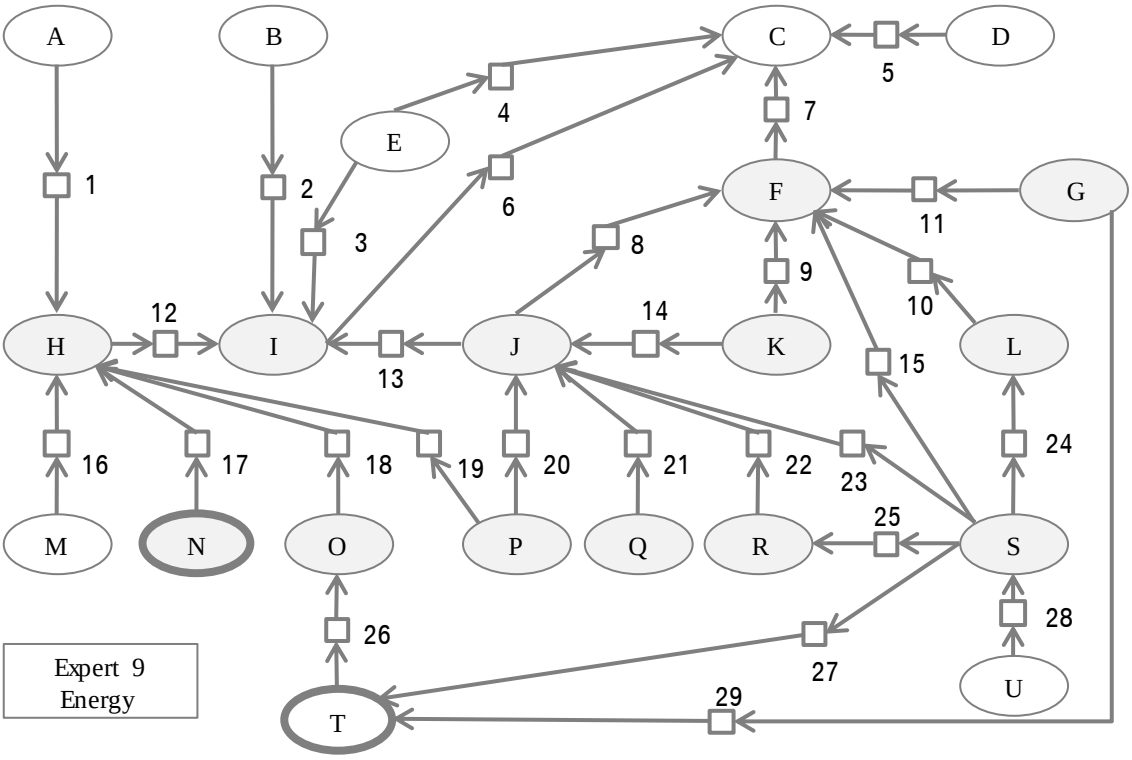
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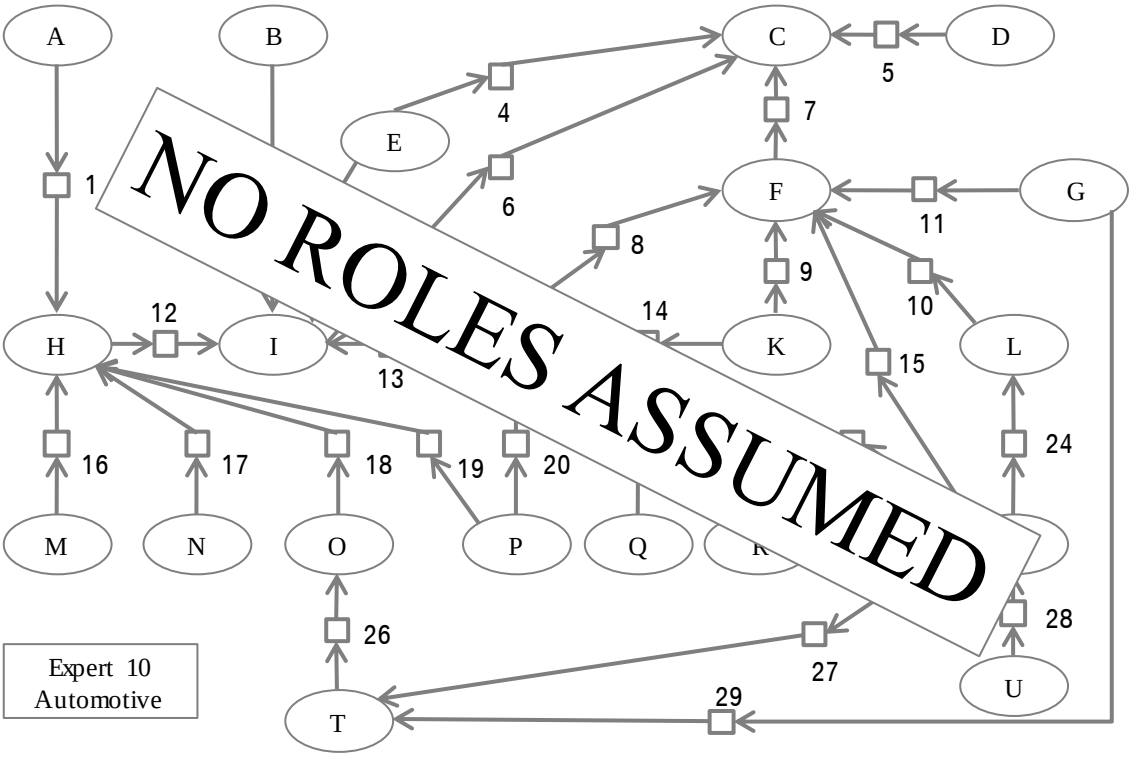
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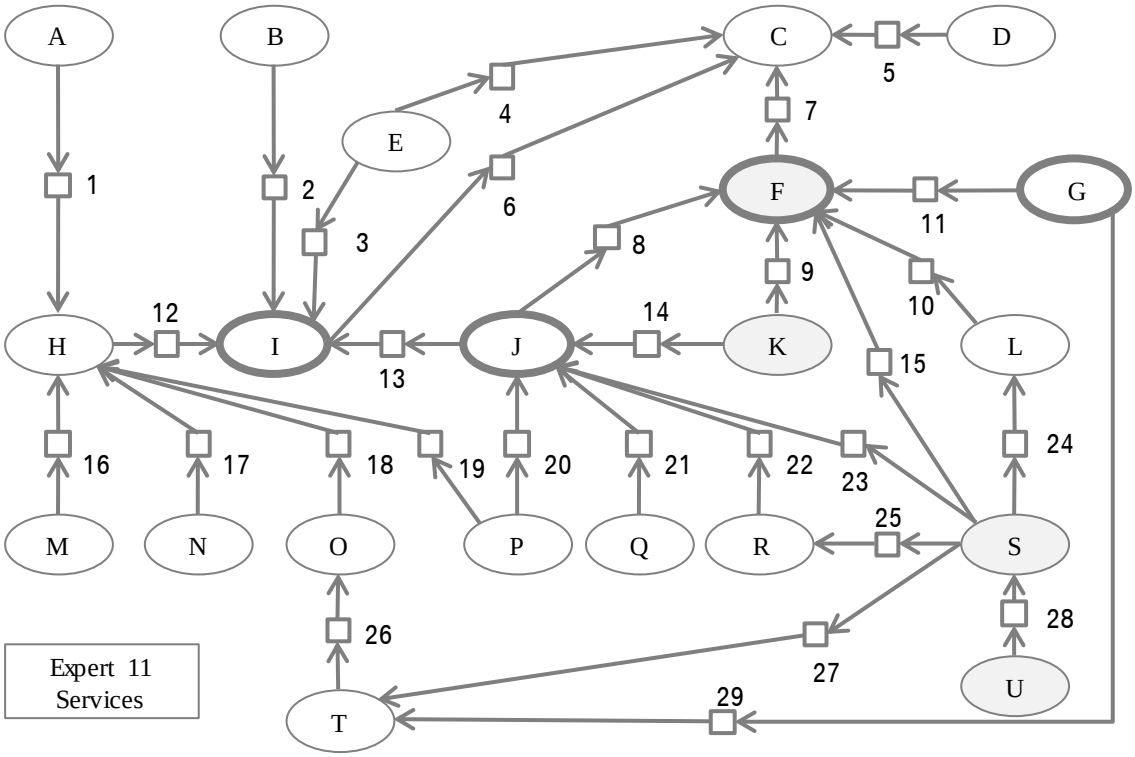
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Expert 11
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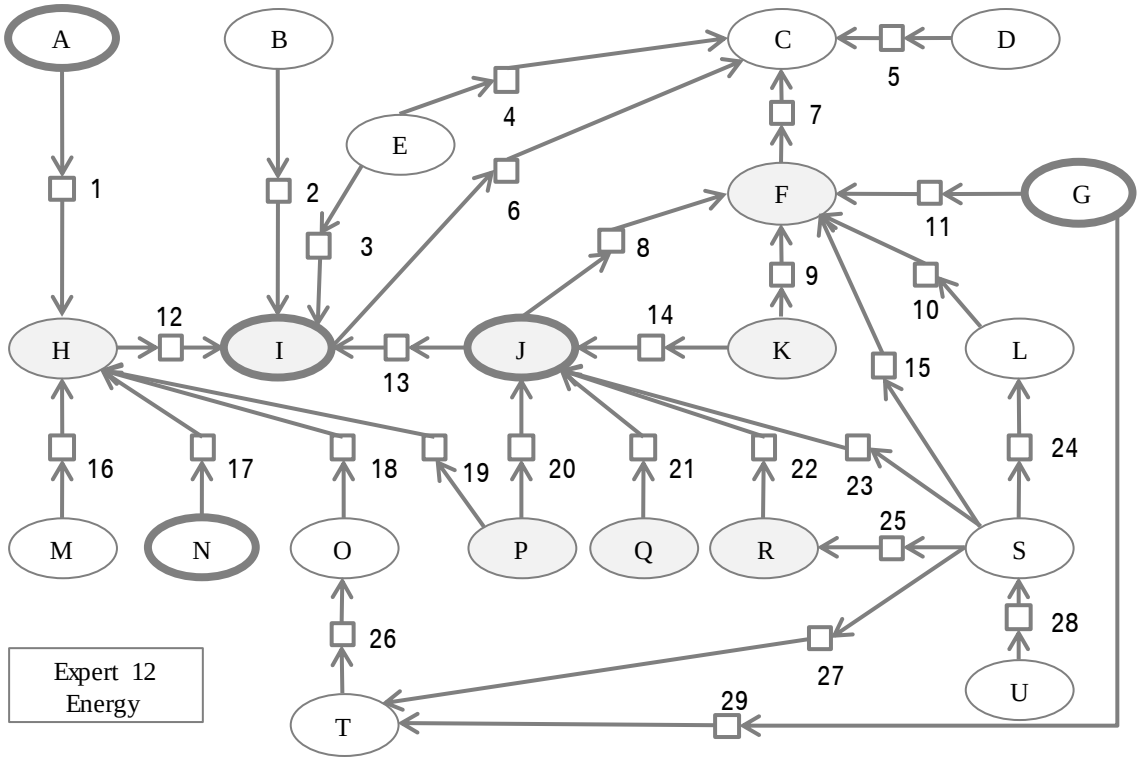
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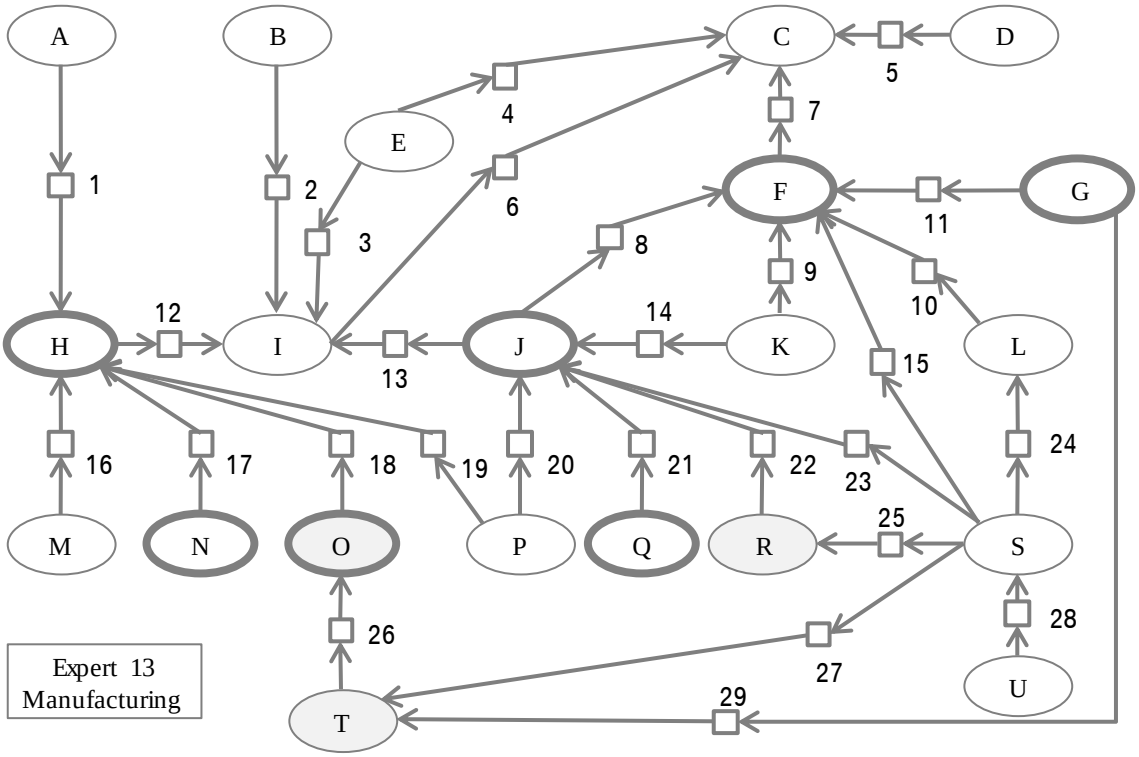
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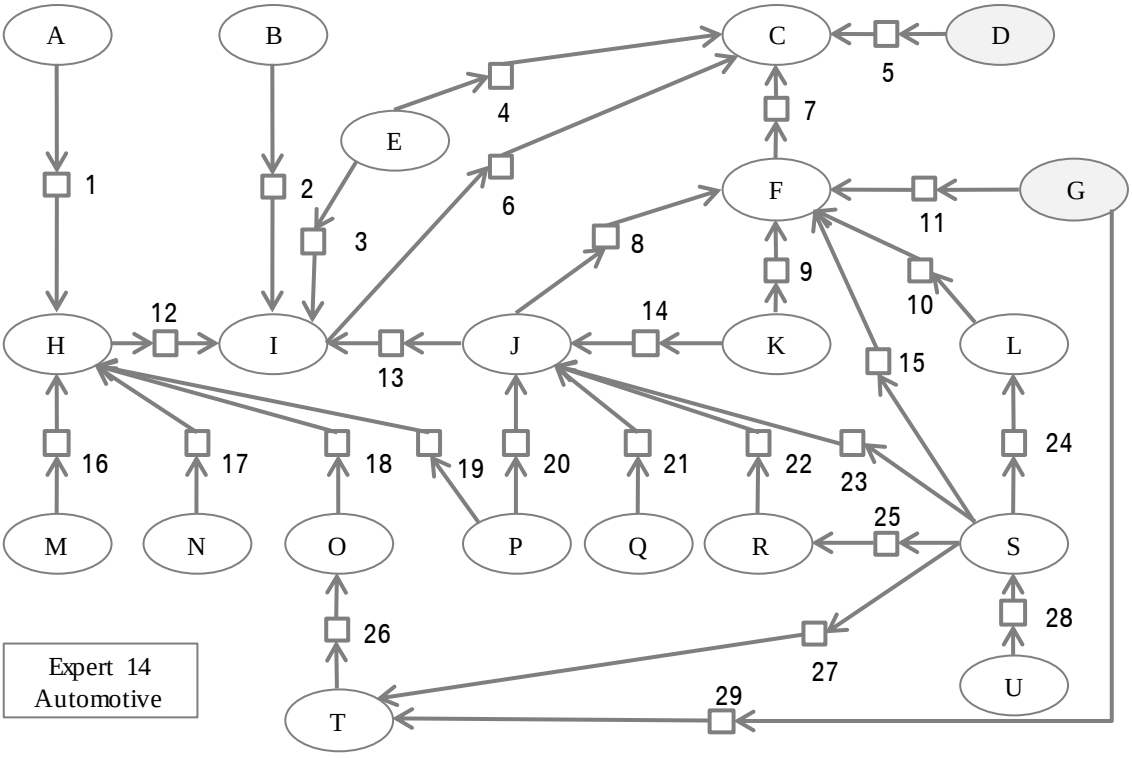
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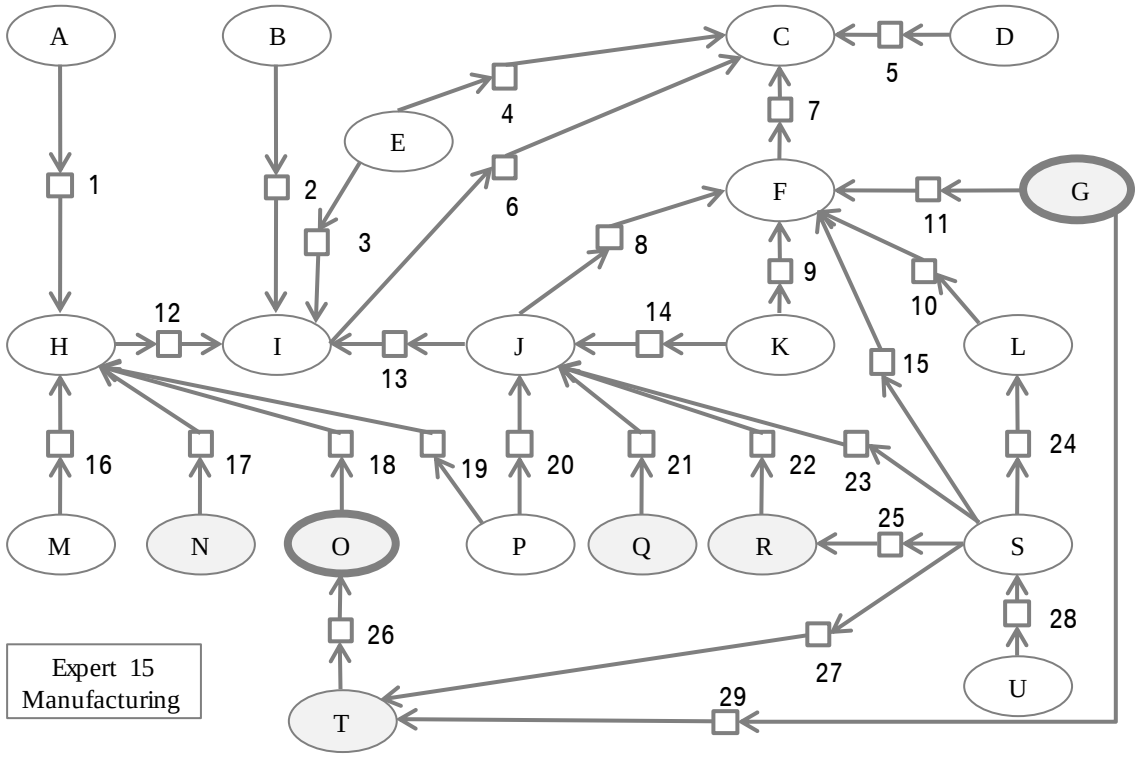
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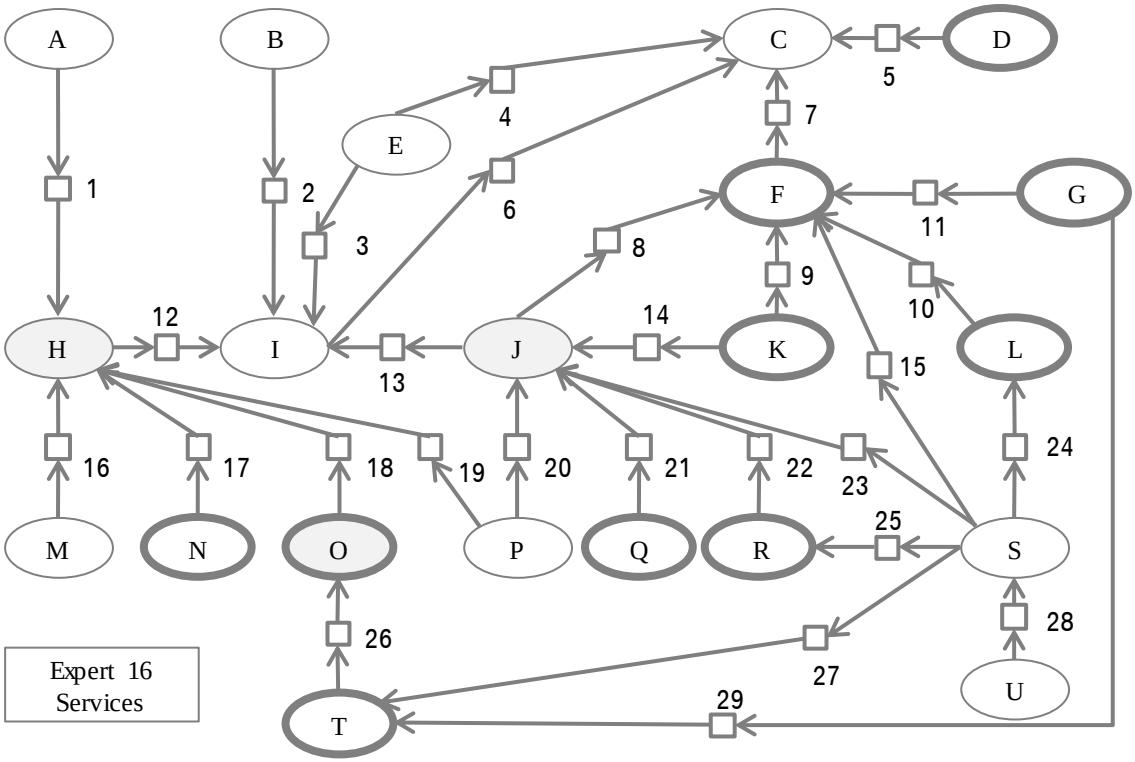
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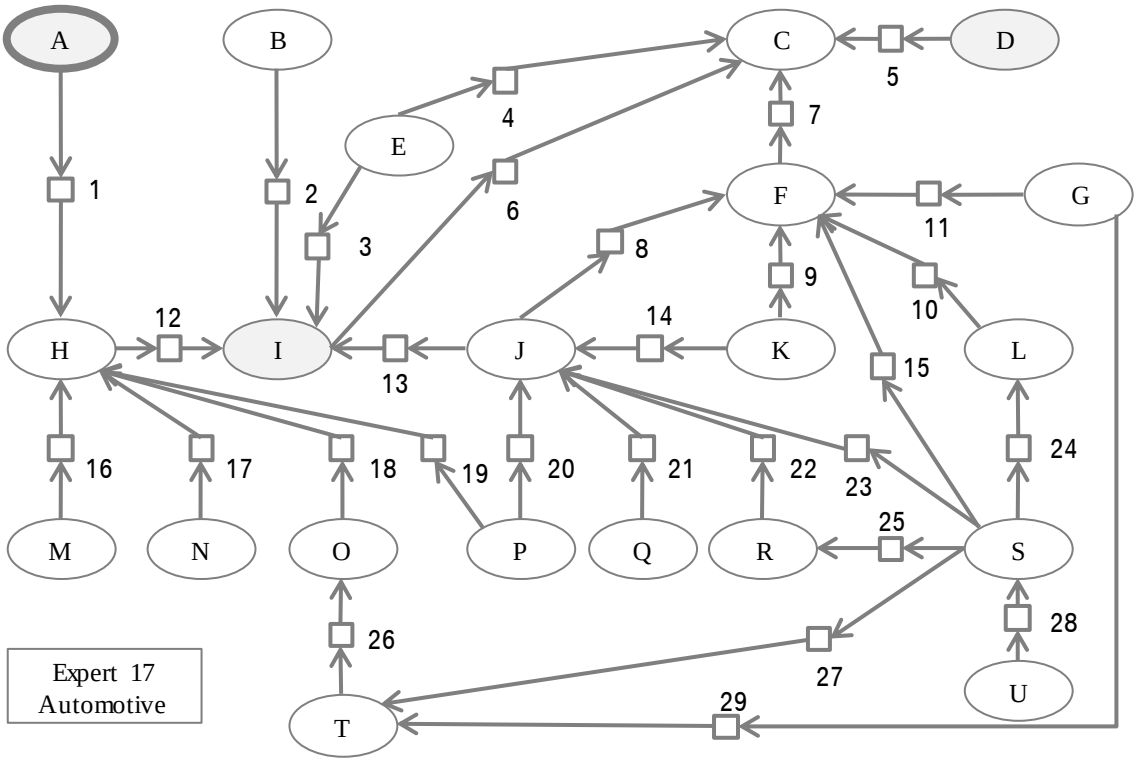
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Questionnaire for the VDAM evaluation in the domain of fast charging infrastructure

Dear expert,
Thank you very much for taking the time to answer the questions on the following 2 spreadsheets. Before you start answering the questions, I would like to begin with a few remarks which are relevant for the questionnaire:

1) Language:
   Other than the expert interviews, the questionnaire is in English. This is due to the fact that the last year has shown, that the topic can be of international relevance and that a few of the experts do not speak German.
2) Role:
   A Role is an abstract construct which is characterized by activities or functionalities. Companies or persons can take on one or several roles. Therefore I would like to ask you to refrain to view company and Role as synonyms. Additionally, roles in the context of the questionnaire are not to be understood as roles in the sense of the German law on the energy industry (EnWG)
3) Value Proposition:
   A Value Proposition describes the promise of value which is delivered from one Role to another Role. Products, Services or bundles of the before mentioned have overall Value Propositions. Therefore I would like to ask you to refrain to view value proposition and product/service as synonyms.

On the following spreadsheets you will find short descriptions of the Roles and Value Propositions which are displayed in the Value Proposition Exchange Diagram (= frame of reference) for the domain of fast charging infrastructure (see pptx). The frame of reference was developed based on the cumulated statements of all experts. Even though the visualization of the statements (= frame of reference) is very important and helpful, the avoidance of misunderstanding and the creation of a real common understanding can only be reached via textual description of the elements (=Ontology building).
Therefore:

- Please read the descriptions and illustrating examples and mark the statements which fit best to your opinion.
- If you have comments, please don't hesitate to fill in the comment section with your suggestions of change.
- If you see other relevant roles, feel free to adapt the frame of reference (pptx) and add a description to the spreadsheets.

Again, thank you very much for taking the time to fill in the questionnaire.

Best regards

Joachim Metzger

Roles (1/2)

Role	Description	Please mark one of the three statements: I fully agree with the description	Please mark one of the three statements: I agree with the key message of the description	Please mark one of the three statements: I disagree with the description	Please mark if correct: My company takes this role	Please mark if correct: A (strategic) partner of my company takes this role	Comments
Access Technology Provider	Role provides access technology like RFID cards and RFID card readers, Apps and QR-Codes, etc to EMPs and the infrastructure manufacturers, thereby ensuring the compatibility.						
Call Center	Role offers (white label) call center services to EMPs and CPOs.						
Charge Point Operator (CPO)	Role is responsible for the correct functionality of the fast charging infrastructure. Thereby the role is mainly coordinating Value Proposistions of other Roles (Energy Supplier, Technical Operator, IT-Operator Chargepoint Management, Roaming Platform, Call Center). By ensuring the accessibility (incl. authentication) to the infrastructure, CPO enables the role EMP to offer access to the infrastructure to EV-Users.						
Charging Station Manufacturer	Role develops and produces fast charging stations in accordance with international standards and known use-cases for fast charging. Additionally the roles is responsible that the charging station is technically enabled to be connected to management systems and has the necessary authentication methods implemented.						
Cross-Seller	Role offers shopping opportunities during the 30 minutes fast charging process. This shopping generates revenue. Parts of the corresponding earnings are being transferred to the investor role.						
Electro Mobility Provider (EMP)	Role offers easy access to public fast charging infrastructure and payment of the corresponding fast charging events						
Energy Supplier	Role provides energy to the fast charging station. Therefore it offers the installation of the initial power supply and also the energy transfer during operations.						
EV-Manufacturer	Role offers Electric Vehicles which are capable of charging at CCS-fast charging infrastructure.						
EV-User	Role drives Electric Vehicles, uses fast charging infrastructure and takes up additional offers during the charging process.						
Governemnt	Role supports the installation of fast charging infrastructure by offering subsidies to Investor.						
Installer	Role conducts all civil and electrical engineering work to install fast charging stations.						

Roles (2/2)

		Please mark one of the three statements			Please mark if correct		
Role	Description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	My company takes this role	A (strategic) partner of my company takes this role	Comments
Investor	Role invests in fast charging infrastructure and thereby covers most of the associated risk. Investor aims at generating a viable business by offering fast-charging towards EV-Users. Investor is, from the EV-user-perspective, responsible for the correct functionality of the fast charging process.						
IT- Operator Roaming Platform	Role offers the operative management of the IT Backend of Roaming Platforms. IT conducts all the necessary operations to allow data transfer and other services of the Roaming Platform.						
IT-Operator of EV Chargepoint Management	Role offers to conduct the operative management of charging stations. This includes the necessary backend solutions for authentication and load management.						
IT-Operator of EV User Management	Role offers to conduct the operative customer management. The role is responsible for all data management concerning the customers, including contract management and billing based on charge detail records.						
Location Provider	Role provides locations for the setup and installation of fast charging infrastructure.						
Public Authorities	Role offers all necessary Licenses and Permissions to install and operate fast charging stations at (semi) public locations.						
Roaming Platform	Role enables EMPs and CPOs to improve their corresponding value propositions by offering a platform to exchange data about charging stations and charging events. Thereby the role sets an operating standard to which charging stations and IT-backends have to comply with.						
Seller of Charging Stations	Role offers appropriate charging stations for specific locations. Thereby the role conducts analysis and consults the setup organizer to allow an informed decision on the kind of infrastructure which is to be installed.						
Setup Organizer	Role organizes the installation process by coordinating Value Propositions of other Roles (Location Provider, Public Authorities, Installer, Seller of Charging Stations, Energy Supplier).						
Technical Operator	Role ensures the technical operability and functionality of charging stations. The role is responsible for conducting maintenance of charging stations as well as repairs in case of failure.						

Value Proposition (1/3)

Value Proposition	Description	Please mark one of the three statements: I fully agree with the definition	I agree with the key message of the definition	I disagree with the definition	Comments
Access to Chargepoints	Customers of EMPs can access the charging stations which are operated by a CPO. Therefore the CPO guarantees a working authentication via the agreed EMP-authentication-medium and ensures the continuing interoperability of the charging station with EVs after an initial testing.				
Appropriate Infrastructure	The appropriate infrastructure is provided on time. Thereby the Charging Station Seller consults the setup ORGANIZER towards what charging station is suited best for a specific location, including number of plugs, necessary connection power and potential restrictions of locations.				
Attractive Charging Locations	Charging location that offer a high frequency of EV user who are willing to charge. Attractiveness is determined by accessibility, offers to use the charging time like shopping, close to planned route (rest stops) and other characteristics that make EV users choose a charging station.				
CCS-fast charging readiness of Evs	Electric vehicle is technically ready to perform CCS fast charging events. Therefore the proper equipment is provided and the interoperability between the car and the infrastructure is ensured.				
Chargepoint Management	IT system to manage the charging stations of an INVESTOR. The IT system provides management solutions like load balancing or supervision and enables the authentication of EV-users on charging stations. Information about the charging process can be used to generate harge Detail Records which are the basis for the subsequent payment by the EMPs.				
Cross financing	Pasing on of earnings generated at charging locations due to EV users				
Customer- friendly fast charging	Easy detection, easy access, easy authenfication and a fast charging event with maximum loading capacity				
customer management	Operations of the IT systems for the EV-user management of an EMP´, including Customer Data management and billing				
Customer-friendly access to as many (semi) public fast charging stations as possible	EV Users have access to as many charging stations as possible of different INVESTORS by using only one contract. Charging stations are easy to find, the access is intuitive and works reliable.				
Declaration of Conformity of Chargepoint Management	A Certificate or seal that shows that a charging station IT system is compatible with the needs of a charging network. This advertises the IT systems compatibility, offers marketing opportunities and sales channels				
Declaration of Conformity of EV-User Management	A Certificate or seal that shows that a Customer Relationship Management IT system is compatible with the needs of a charging network. This advertises the IT systems compatibility, offers marketing opportunities and sales channels				
Declaration of Conformity of fast charging stations	A Certificate or seal that shows that a charging station is compatible with the needs of a charging network. This advertises the charging infrastructure's compatibility, offers marketing opportunities and sales channels				

Value Proposition (2/3)

Value Proposition	Description	Please mark one of the: I fully agree with the definition	I agree with the key message of the definition	I disagree with the definition	Comments
Energy	Energy needed during the charging process is provided				
Fast Charging Station	Providing of fast charging stations which are in accordance to international standards, compatible and interoperable with all EVs that build on the same technology				
High number of chargepoints for low transaction costs	Via one API, charging stations of many different CPOs can be accessed by the customers of the EMP				
High Reach of Customers for Low Transaction Costs	Via one API, many different EMPs and their respective customers can get access to charging stations of a CPO and charge their.				
Hotline for EV-Users	In case of questions, orders or complaints, EV-users might want to call a hotline. This service is provided by the Role, often as a "whitelabel" service, so that the caller thinks that she is calling the EMP itself and not some service provider.				
Hotline for EV-Users and EMPs	In case of questions or complaints, EV-users or EMPs might want to contact the owner (operator) of fast charging infrastructure. This service is provided by the Role, often as a "whitelabel" service, so that the caller thinks that she is calling the CPO-role itself.				
Installed Infrastructure	Fast charging infrastructure is installed on time including all necessary steps of underground work and electrical connection.				
Licenses and Permissions	all Licenses and Permissions that are necessary for the installation and subsequent operations of a fast charging station				
Maintenance and repair	High level of technical availability of chariing stations based on maintenance, remote and onside. Repair in case of malfunction is conducted in accordance to the Service Level Agreement, either remote or onsite, if necessary.				
Power Supply	Providing of a Power Supply with the necessary electric power to enable fast charging events at the planned location				
Shopping opportunities during the charging process	A fast charging event takes up to 30 minutes. During this times, customers have the opportunity to make use of this time by doing shopping of some sort. Examples of this are grocery shopping, having a coffee or other drink or do some cloth shopping nearby				
Subsidies	Governmental subsidies to support the installation of fast charging stations at relevant locations to support eMobility				
Turnkey Solution for Charging Infrastructure	Fully functional, installed infrastructure at a specific charging station including all necessary licenses and permissions will be handed over to INVESTOR				

Value Proposition (3/3)

Value Proposition	Description	Please mark one of the: I fully agree with the definition	I agree with the key message of the definition	I disagree with the definition	Comments
Working Access technologies for charging stations	Access technologies like RFID card reader or QR tags that enable CPO and EMP to grant access to the charging station to individuals by checking the validity of an authorization.				
Working Access technologies for EV Users	Access technologies that enable customers of EMPs to get authorization to charge at specific charging locations. Hereby the goal is to ensure technological compatibility between the authentication medium (Card, QR-Reader) and the devices at the charging stations				
Working Infrastructure for EV-Users	Fully operational fast charging infrastructure within the limits of the Service Level Agreements.				
Working Roaming Platform	High level of operational availability of the Roaming platform including operation, maintenance, connection of new EMP- and CPO-backends and further development of the platform itself				

Evaluation results for the domain of fast charging infrastructure: Roles

	Industry Affiliation	Automotive			Services			Manufacturing			Energy			Manufacturing			Manufacturing			Services			All			
	Expert	B2			B6			B8			B9			B13			B15			B16			Aggregated Results			
Role	Description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	no answer
Access Technology Provider	Role provides access technology like RFID cards and RFID card readers, Apps and QR-Codes, etc to EMPs and the infrastructure manufacturers, thereby ensuring the compatibility.	X				X			X			X			X			X		X			**2**	**5**		
Call Center	Role offers (white label) call center services to EMPs and CPOs.		X		X				X		X			X				X		X			**4**	**3**		
Charge Point Operator (CPO)	Role is responsible for the correct functionality of the fast charging infrastructure. Thereby the role is mainly coordinating Value Propositions of other Roles (Energy Supplier, Technical Operator, IT-Operator Chargepoint Management, Roaming Platform, Call Center).By ensuring the accessibility (incl. authentication) to the infrastructure, CPO enables the role EMP to offer access to the infrastructure to EV-Users.		X		X				X			X		X				X		X			**3**	**4**		
Charging Station Manufacturer	Role develops and produces fast charging stations in accordance with international standards and known use-cases for fast charging. Additionally the roles is responsible that the charging station is technically enabled to be connected to management systems and has the necessary authentication methods		X		X			X				X		X			X			X			**5**	**2**		
Cross-Seller	Role offers shopping opportunities during the 30 minutes fast charging process. This shopping generates revenue. Parts of the corresponding earnings are being transferred to the investor role.		X			X		X				X			X			X			X		**1**	**6**		
Electro Mobility Provider (EMP)	Role offers easy access to public fast charging infrastructure and payment of the corresponding fast charging events	X				X		X				X		X				X		X			**4**	**3**		
Energy Supplier	Role provides energy to the fast charging station. Therefore it offers the installation of the initial power supply and also the energy transfer during operations.		X		X			X					X	X				X		X			**4**	**2**	**1**	
EV-Manufacturer	Role offers Electric Vehicles which are capable of charging at CCS-fast charging infrastructure.		X		X			X			X			X				X			X		**4**	**3**		
EV-User	Role drives Electric Vehicles, uses fast charging infrastructure and takes up additional offers during the charging process.		X		X			X			X			X				X		X			**5**	**2**		
Governemnt	Role supports the installation of fast charging infrastructure by offering subsidies to Investor.			X		X			X			X		X				X			X		**1**	**5**	**1**	
Installer	Role conducts all civil and electrical engineering work to install fast charging stations.	X			X			X			X			X			X			X			**7**			
Investor	Role invests in fast charging infrastructure and thereby covers most of the associated risk. Investor aims at generating a viable business by offering fast-charging towards EV-Users. Investor is, from the EV-user-perspective, responsible for the correct functionality of the fast charging process.	X			X			X			X			X				X			X		**5**	**2**		
IT-Operator Roaming Platform	Role offers the operative management of the IT Backend of Roaming Platforms. IT conducts all the necessary operations to allow data transfer and other services of the Roaming Platform.	X				X		X			X				X			X		X			**4**	**3**		
IT-Operator of EV Chargepoint Management	Role offers to conduct the operative management of charging stations. This includes the necessary backend solutions for authentication and load management.	X			X			X				X		X				X		X			**5**	**2**		
IT-Operator of EV User Management	Role offers to conduct the operative customer management. The role is responsible for all data management concerning the customers, including contract management and billing based on charge detail records.	X			X			X			X			X				X		X			**6**	**1**		
Location Provider	Role provides locations for the setup and installation of fast charging infrastructure.	X			X				X		X				X			X		X			**4**	**3**		
Public Authorities	Role offers all necessary Licenses and Permissions to install and operate fast charging stations at (semi) public locations.		X		X					X	X			X				X		X			**4**	**2**	**1**	
Roaming Platform	Role enables EMPs and CPOs to improve their corresponding value propositions by offering a platform to exchange data about charging stations and charging events. Thereby the role sets an operating standard to which charging stations and IT-backends have to comply with.	X					X		X			X			X			X		X			**2**	**4**	**1**	
Seller of Charging Stations	Role offers appropriate charging stations for specific locations. Thereby the role conducts analysis and consults the setup organizer to allow an informed decision on the kind of infrastructure which is to be installed.		X		X				X		X			X				X		X			**4**	**3**		
Setup Organizer	Role organizes the installation process by coordinating Value Propositions of other Roles (Location Provider, Public Authorities, Installer, Seller of Charging Stations, Energy Supplier).		?		X				X		X				X			X		X			**3**	**3**		**1**
Technical Operator	Role ensures the technical operability and functionality of charging stations. The role is responsible for conducting maintenance of charging stations as well as repairs in case of failure.	X				X		X			X			X				X		X			**5**	**2**		

Evaluation results for the domain of fast charging infrastructure: Value Propositions (1/2)

	Industry Affiliation	Automotive			Services			Manufacturing			Energy			Manufacturing			Manufacturing			Services			All			
	Expert	B2			B6			B8			B9			B13			B15			B16			Aggregated Results			
Role	Description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	no answer
Access to Chargepoints	Customers of EMPs can access the charging stations which are operated by a CPO. Therefore the CPO guarantees a working authentication via the agreed EMP-authentication-medium and ensures the continuing interoperability of the charging station with EVs after an initial testing.	X				X		X			X			X				X			X		4	3		
Appropriate Infrastructure	The appropriate infrastructure is provided on time. Thereby the Charging Station Seller consults the setup ORGANIZER towards what charging station is suited best for a specific location, including number of plugs, necessary connection power and potential restrictions of locations.	X			X			X				X		X				X		X			5	2		
Attractive Charging Locations	Charging location that offer a high frequency of EV user who are willing to charge. Attractiveness is determined by accessibility, offers to use the charging time like shopping, close to planned route (rest stops) and other characteristics that make EV users choose a charging station.	X			X			X				X		X				X			X		4	3		
CCS-fast charging readiness of Evs	Electric vehicle is technically ready to perform CCS fast charging events. Therefore the proper equipment is provided and the interoperability between the car and the infrastructure is ensured.	X				X		X				X		X				X		X			4	3		
Chargepoint Management	IT system to manage the charging stations of an INVESTOR. The IT system provides management solutions like load balancing or supervision and enables the authentication of EV-users on charging stations. Information about the charging process can be used to generate harge Detail Records which are the basis for the subsequent payment by the EMPs.	X				X		X				X		X				X		X			4	3		
Cross financing	Pasing on of earnings generated at charging locations due to EV users	X				X		X			X				X			X		X			4	3		
Customer-friendly fast charging	Easy detection, easy access, easy authenfication and a fast charging event with maximum loading capacity	X			X			X			X			X				X		X			6	1		
customer management	Operations of the IT systems for the EV-user management of an EMP´, including Customer Data management and billing	X				X		X			X			X				X		X			5	2		
Customer-friendly access to as many (semi) public fast charging stations as possible	EV Users have access to as many charging stations as possible of different INVESTORS by using only one contract. Charging stations are easy to find, the access is intuitive and works reliable.	X				X			X			X		X				X		X			3	4		
Declaration of Conformity of Chargepoint Management	A Certificate or seal that shows that a charging station IT system is compatible with the needs of a charging network. This advertises the IT systems compatibility, offers marketing opportunities and sales channels	X			X					X				X				X		X			4	1	1	1
Declaration of Conformity of EV-User Management	A Certificate or seal that shows that a Customer Relationship Management IT system is compatible with the needs of a charging network. This advertises the IT systems compatibility, offers marketing opportunities and sales channels	X			X					X				X				X		X			4	1	1	1
Declaration of Conformity of fast charging stations	A Certificate or seal that shows that a charging station is compatible with the needs of a charging network. This advertises the charging infrastructure's compatibility, offers marketing opportunities and sales channels	X			X					X				X				X		X			4	1	1	1
Energy	Energy needed during the charging process is provided	X			X			X			X				X			X		X			5	2		
Fast Charging Station	Providing of fast charging stations which are in accordance to international standards, compatible and interoperable with all EVs that build on the same technology		X		X			X			X			X				X		X			5	2		
High number of chargepoints for low transaction costs	Via one API, charging stations of many different CPOs can be accessed by the customers of the EMP		X			X		X						X				X		X			3	3	0	1
High Reach of Customers for Low Transaction Costs	Via one API, many different EMPs and their respective customers can get access to charging stations of a CPO and charge their.		X			X		X						X				X		X			3	3	0	1
Hotline for EV-Users	In case of questions, orders or complaints, EV-users might want to call a hotline. This service is provided by the Role, often as a "whitelabel" service, so that the caller thinks that she is calling the EMP itself and not some service provider.		X		X			X			X			X				X		X			5	2		

Evaluation results for the domain of fast charging infrastructure: Value Propositions (2/2)

	Industry Affiliation	Automotive			Services			Manufacturing			Energy			Manufacturing			Manufacturing			Services			All			
	Expert	B2			B6			B8			B9			B13			B15			B16			Aggregated Results			
Role	Description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	I fully agree with the description	I agree with the key message of the description	I disagree with the description	no answer
Hotline for EV-Users and EMPs	In case of questions or complaints, EV-users or EMPs might want to contact the owner (operator) of fast charging infrastructure. This service is provided by the Role, often as a "whitelabel" service, so that the caller thinks that she is calling the CPO-role itself.		x		x			x			x			x				x		x			5	2		
Installed Infrastructure	Fast charging infrastructure is installed on time including all necessary steps of underground work and electrical connection.		x		x			x			x			x				x		x			5	2		
Licenses and Permissions	all Licenses and Permissions that are necessary for the installation and subsequent operations of a fast charging station	x			x					x	x			x				x		x			5	1	1	
Maintenance and repair	High level of technical availability of chariing stations based on maintenance, remote and onside. Repair in case of malfunction is conducted in accordance to the Service Level Agreement, either remote or onsite, if necessary.		x		x			x			x			x				x		x			5	2		
Power Supply	Providing of a Power Supply with the necessary electric power to enable fast charging events at the planned location	x			x			x			x			x				x		x			6	1		
Shopping opportunities during the charging process	A fast charging event takes up to 30 minutes. During this times, customers have the opportunity to make use of this time by doing shopping of some sort. Examples of this are grocery shopping, having a coffee or other drink or do some cloth shopping nearby		x		x				x		x			x				x		x			4	3		
Subsidies	Governmental subsidies to support the installation of fast charging stations at relevant locations to support eMobility	x			x				x		x			x				x			x		4	3		
Turnkey Solution for Charging Infrastructure	Fully functional, installed infrastructure at a specific charging station including all necessary licenses and permissions will be handed over to INVESTOR	x				x		x			x			x				x		x			5	2		
Working Access technologies for charging stations	Access technologies like RFID card reader or QR tags that enable CPO and EMP to grant access to the charging station to individuals by checking the validity of an authorization.	x			x			x				x		x				x		x			5	2		
Working Access technologies for EV Users	Access technologies that enable customers of EMPs to get authorization to charge at specific charging locations. Hereby the goal is to ensure technological compatibility between the authentication medium (Card, QR-Reader) and the devices at the charging stations	x			x			x			x			x				x		x			6	1		
Working Infrastructure for EV-Users	Fully operational fast charging infrastructure within the limits of the Service Level Agreements.	x			x			x			x			x				x		x			6	1		
Working Roaming Platform	High level of operational availability of the Roaming platform including operation, maintenance, connection of new EMP- and CPO-backends and further development of the platform itself	x				x		x			x			x				x		x			5	2		

Questionnaire for the VDAM evaluation in other domains

Fragebogen zum Value Delivery Architecture Modeling Framework

Karlsruhe, den
16.12.2016

Name: _____

Firma _____

Branche _____

Position _____

Nr	Frage	Bitte kreuzen Sie eine der folgenden drei Optionen an: Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu
1	VDAM vereinfacht die Kommunikation und Diskussion über das Wertschöpfungsnetzwerk in einer Domäne	☐	☐	☐
2	VDAM stärkt das Verständnis für das Wertschöpfungsnetzwerk in einer Domäne	☐	☐	☐
3	VDAM ermöglicht die exakte Positionierung von Firmen im Wertschöpfungsnetzwerk einer Branche	☐	☐	☐
4	VDAM schafft die Vergleichbarkeit von Unternehmen inklusive deren Positionierung im Wertschöpfungsnetzwerk	☐	☐	☐
5	VDAM ermöglicht die Erarbeitung neuer Geschäftsmodellideen und visualisiert deren Auswirkungen auf das Wertschöpfungsnetzwerk	☐	☐	☐
6	VDAM fördert die Operationalisierung von Geschäftsmodellideen durch die Modellierbarkeit unterschiedlicher Perspektiven	☐	☐	☐
7	VDAM ist eine wertvolle Ergänzung im Bereich Geschäftsmodell- beschreibung und -entwicklung	☐	☐	☐
8	Ich werde VDAM in meinem Unternehmen weiter anwenden, da er mein persönliches Toolset für strategische Fragestellungen sinnvoll ergänzt	☐	☐	☐

weitere Kommentare

_____

_____

_____

_____

_____

_____

Replies and evaluation results for other domains - Overview

Nr	Frage	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	keine Antwort
1	VDAM vereinfacht die Kommunikation und Diskussion über das Wertschöpfungsnetzwerk in einer Domäne	8	9	0	
2	VDAM stärkt das Verständnis für das Wertschöpfungsnetzwerk in einer Domäne	15	2		
3	VDAM ermöglicht die exakte Positionierung von Firmen im Wertschöpfungsnetzwerk einer Branche	5	12		
4	VDAM schafft die Vergleichbarkeit von Unternehmen inklusive deren Positionierung im Wertschöpfungsnetzwerk	3	13	1	
5	VDAM ermöglicht die Erarbeitung neuer Geschäftsmodellideen und visualisiert deren Auswirkungen auf das Wertschöpfungsnetzwerk	8	9		
6	VDAM fördert die Operationalisierung von Geschäftsmodellideen durch die Modellierbarkeit unterschiedlicher Perspektiven	7	9		1
7	VDAM ist eine wertvolle Ergänzung im Bereich Geschäftsmodell-beschreibung und -entwicklung	8	7	2	
8	Ich werde VDAM in meinem Unternehmen weiter anwenden, da er mein persönliches Toolset für strategische Fragestellungen sinnvoll ergänzt	5	4	8	

Replies and evaluation results for other domains - Details

Nr	Statement	1			2			3			4			5			6			7			8			9		
		Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu
1	VDAM vereinfacht die Kommunikation und Diskussion über das Wertschöpfungsnetzwerk in einer Domäne	x				x		x				x			x		x				x		x				x	
2	VDAM stärkt das Verständnis für das Wertschöpfungsnetzwerk in einer Domäne	x			x			x			x			x			x			x			x			x		
3	VDAM ermöglicht die exakte Positionierung von Firmen im Wertschöpfungsnetzwerk einer Branche		x			x			x			x			x			x		x			x				x	
4	VDAM schafft die Vergleichbarkeit von Unternehmen inklusive deren Positionierung im Wertschöfpfungsnetzwerk	x				x			x			x				x		x			x			x			x	
5	VDAM ermöglicht die Erarbeitung neuer Geschäftsmodellideen und visualisiert deren Auswirkungen auf das Wertschöpfungsnetzwerk		x			x		x			x				x		x				x			x		x		
6	VDAM fördert die Operationalisierung von Geschäftsmodellideen durch die Modellierbarkeit unterschiedlicher Perspektiven	x			x			x				x		x				x			x			x			x	
7	VDAM ist eine wertvolle Ergänzung im Bereich Geschäftsmodell- beschreibung und -entwicklung	x				x		x					x		x			x			x		x					x
8	Ich werde VDAM in meinem Unternehmen weiter anwenden, da er mein persönliches Toolset für strategische Fragestellungen sinnvoll ergänzt	x					x	x					x			x		x		x					x		x	

Nr	Statement	10			11			12			13			14			15			16			17		
		Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu	Ich stimme voll und ganz zu	Ich stimme teilweise zu	Ich stimme nicht zu
1	VDAM vereinfacht die Kommunikation und Diskussion über das Wertschöpfungsnetzwerk in einer Domäne		x			x		x				x		x				x		x			x		
2	VDAM stärkt das Verständnis für das Wertschöpfungsnetzwerk in einer Domäne	x			x			x				x		x				x		x			x		
3	VDAM ermöglicht die exakte Positionierung von Firmen im Wertschöpfungsnetzwerk einer Branche	x				x			x		x			x				x			x			x	
4	VDAM schafft die Vergleichbarkeit von Unternehmen inklusive deren Positionierung im Wertschöfpfungsnetzwerk	x				x		x				x			x			x			x			x	
5	VDAM ermöglicht die Erarbeitung neuer Geschäftsmodellideen und visualisiert deren Auswirkungen auf das Wertschöpfungsnetzwerk	x				x			x			x		x				x		x			x		
6	VDAM fördert die Operationalisierung von Geschäftsmodellideen durch die Modellierbarkeit unterschiedlicher Perspektiven	x				x			x			x						x		x			x		
7	VDAM ist eine wertvolle Ergänzung im Bereich Geschäftsmodell- beschreibung und -entwicklung	x				x			x			x		x			x			x			x		
8	Ich werde VDAM in meinem Unternehmen weiter anwenden, da er mein persönliches Toolset für strategische Fragestellungen sinnvoll ergänzt	x					x			x			x		x				x		x		x		

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