Value Delivery Architecture Modeling – A new Approach for Business Modeling

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ABSTRACT

Complexity and uncertainty have evolved as important challenges for entrepreneurship in many industries. Value Delivery Architecture Modeling (VDAM) is a proposal for a new approach for business modeling to conquer these challenges. In addition to the creation of transparency and clarity, our approach supports the operationalization of business model ideas. VDAM is based on the combination of a new business modeling language called VDML, ontology building, and the implementation of a level of cross-company abstraction. The application of our new approach in the area of electric mobility in Germany, an industry sector with high levels of uncertainty and a lack of common understanding, shows several promising results: VDAM enables the development of an unambiguous and unbiased view on value creation. Additionally it allows for several applications leading to a more informed decision towards the implementation of new business models.

Keywords: Business Model, Operationalization, VDML, Ontology, Value Creation Network, Electric Mobility

1. INTRODUCTION

A key element of research in the field of entrepreneurship is the question of how to describe and develop business models. However, there is still a variety of definitions and understandings among researchers of what a Business Model is or should be [2, 6, 9, 21]. Complexity and uncertainty are some of the biggest challenges for entrepreneurship in today's complex and interrelated world, being relevant for most industries. Often value creation is not a straight process any longer but value has to be created in complex networks. Amongst other things, complexity and uncertainty cause a gap between strategy and business processes, as Al-Debei and Avison show for digital business. Therefore, business models should be regarded as a theoretical intermediate layer connecting strategy with business processes [1].

Many of the well-known business modeling languages tend to focus on the strategic aspects of business models. This holds even for languages suggested by researchers agreeing with the intermediary role of business models [15]. These approaches are appropriate for business model development and innovation by taking strategic points of view and using only few elements for its description. 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. In addition, these languages do not include tools to support the operationalization of business models [1, 8, 16]. Nevertheless, both we deem necessary to stimulate successful entrepreneurial engagement in today's globalized and complex world.

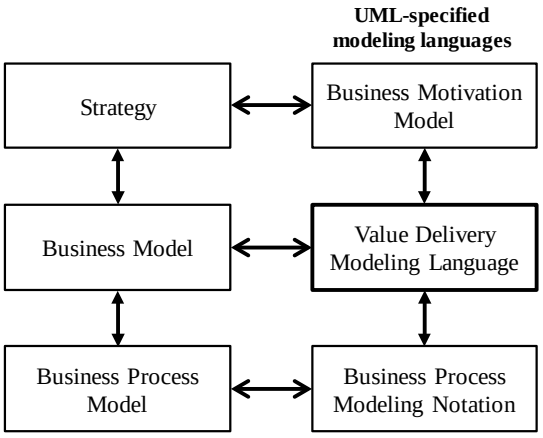
The scope of this paper is to introduce a proposal for a new approach for business modeling, combining Value Delivery Modeling Language and Ontologies with an abstract view of value creation in markets which allows for the depiction and reduction of complexity, creation of transparency as well as support for operationalizating business models. We call this approach Value Delivery Architecture Modeling (VDAM).

2. THEORETICAL BACKGROUND

Design Science produces four types of artifacts, namely constructs, models, methods, and instantiations [10], and originated in engineering and the sciences of the artificial [19]. We chose to follow a Design Science approach with the goal to develop an innovative and purposeful artifact – VDAM – which conquers the challenges of business modeling in complex and uncertain environments and supports its operationalization. During all steps of the process we complied with the research framework and guidelines for Design Science introduced by Hevner et al., which are based on the principle that knowledge and understanding are derived from the building, application and, evaluation of an artifact [7]

To reach our goal to create transparency and clarity in addition to including operationalization-supporting methods in one integrated business modeling approach, we base our proposed

approach on two existing artifacts: Value Delivery Modeling Language (VDML) [12, 13] and Ontologies in Business Modeling [14].



1 - Business Models as Intermediaries [1] and examples of UML-specified modeling languages [12, 13]

VDML has been first released in a beta version by Object Management Group in April 2014 [12]. Acting as an intermediary between strategy and business processes, VDML offers answers to the challenges in today's business modeling (see Figure 1). Thus, VDML is a well-suited language for our goal of creating an operationalization-supporting approach for business modeling. VDML has its origins in Information Systems (IS) and is a UML-specified approach for business modeling. By providing a standard modeling language, VDML enables modeling of value creation as well as value exchange on a strategic level. Furthermore, VDML was developed to link strategy and business models to activities, roles, capabilities necessary to run a company. Thus, it provides a language for analysis and design of business models on a more operational level. VDML incorporates several types of diagrams included in the following views:

- Business Network view
- Activity Network view
- Organization Responsibility View
- Value Contribution View.

Furthermore, VDML supports several existing business modeling and business analysis approaches such as Business Model Canvas or Value Networks [12, 13]. Already in pre-beta-versions, developers of VDML showed how the language can successfully be used for business model innovation. This includes applications for services, processes, and open business model innovation. These applications are focusing on traditional approaches and concentrating on single companies and their immediate partners [3, 4, 5, 18]

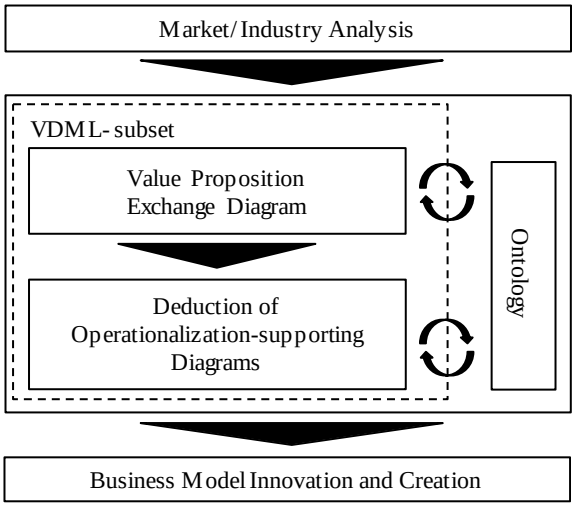
In addition to using an operationalization-supporting language, we deem it necessary to create transparency, clarity, and a common understanding within and between stakeholders and organizations, especially in today's often complex and distributed value creation. Therefore we combine the use of VDML diagrams for the visualization of value creation and exchange with the concept of semi-formal ontologies. Ontologies, originated in Philosophy, nowadays are in widespread use in the area of IS as explicit specifications of conceptualizations. Ontologies aim at creating a common understanding in a field to solve problems or share knowledge. Thereby, main focus is an improved communication between people, organizations, and machines which leads to an improved interoperability between and an enhanced development of systems. While designing an ontology, it is essential to comply with the following three guidelines:

- Clarity, in the sense of minimized ambiguity.
- Coherence, in the sense of an internal consistency.
- Extensibility of the designed ontology [20].

In accordance with Uschold & Grunninger's approach of ontology building, including the steps of capturing, coding, evaluation, and documentation, Osterwalder transferred the concept of ontology from IS to business modeling. The development of a semi-formal ontology, simply called the Business Model Ontology, has been the basis for the well-known approach Business Model Canvas [14, 15, 16]. Since then other researchers [e.g. 1] picked up on this concept of ontology and nowadays it is a prevailing element in Business Modeling.

3. VALUE DELIVERY ARCHITECTURE MODELING

To conquer challenges of complexity, collaborative value creation, and missing operationalization in business modeling, we propose an approach we refer to as Value Delivery Architecture Modeling. Based on information on the market, we create an unambiguous understanding of value creation and business opportunities by combining a subset of VDML elements and views with the development of a semi-formal ontology. Thereby, the design of these different views and the definition in an ontology is an iterative process. This enables a number of applications to innovate or create business models. Allowing more in-depth analysis and development, VDAM is suitable for initial, more strategic analysis of business models and for supporting the operationalization of business models (see Figure 2).



2- The VDAM framework based on VDML [12, 13] and Ontology design [14]

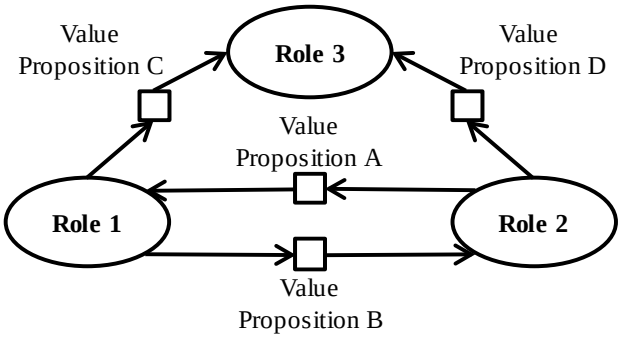
Key to our approach is the implementation of an additional level of cross-company abstraction, initially leaving specific companies and their business models behind while focusing on abstract Roles, Value Propositions and other elements. This abstraction provides an unbiased view on how value is created in

complex and uncertain market situations, laying the foundation to conduct business model innovation or business model creation. In the following we introduce the key concepts and ideas of VDAM by describing the development of the most strategic view of our approach. Other views integrated in VDAM will not be explained in such detail.

Market analysis can be conducted in numerous ways reaching from complex business intelligence efforts to expert interviews. Using this information, the first and most strategic type of diagram in our approach is being designed, using 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 3). 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 [12, 13]. A Value Proposition Exchange diagram 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 multiset of arcs.

As a result one specific Value Proposition can only be offered from one Role to one other Role. Furthermore, since Roles and Value Propositions must not be identical, we define that Roles and Value Propositions cannot have the same names. Following this approach, the resulting Value Proposition Exchange Diagram visualizes and describes the value creation in a market from a more strategic perspective. Due to the use of abstract Roles an unbiased view is created.



3 - Value Proposition Exchange Diagram from VDML [12, 13]

A graphical representation facilitates the general understanding of interrelations between Roles and their corresponding Value Propositions. However, in order to create an unambiguous understanding between all parties involved, the description within an ontology is necessary. The information displayed in the ontology is based on the requirements of the VDML elements used in our approach. Therefore, in addition to the elements Role and Value Proposition which are part of the Value Proposition Exchange Diagram, further elements such as Capability, Activity or Value have to be included in the ontology. These elements are needed for the design of more detailed and therewith operationalization-supporting views. For the description of the ontology elements we concluded that Osterwalder's notation suffices the needs of VDAM. As listed in Figure 4, it includes seven categories: Name of the Element, Definition, Part of, Related to, Set of, Cardinality, and Attributes [14].

Name and Definition are being used to specifically describe the elements and create a common understanding. The categories Part of, Related to, and Set of are being used to describe the semantic relationship of elements to each other. Generally, elements can be decomposed into sub-elements to allow for different levels of granularity in analysis and the following development of business models. For instance, an element Value Proposition can be decomposed in several Value Proposition Components. The cardinality defines the number of possible appearances of elements in the approach. By definition the cardinality of the entities of Role and Value Proposition has to be one. The entities of other elements which are used in the more detailed and therefore operationalization-supporting views can have other cardinalities. This enables reuse of these elements during the design process when deemed helpful. For example an Activity 'consulting' can be part of several key meta-processes and can be based on the same Capabilities. Finally the category Attributes defines what attributes have to be used to describe entities of an ontology element.

Name of the Element	**VALUE PROPOSITION**
Definition	VALUE PROPOSITION represents tangible or intangible VALUE offered by a ROLE towards another ROLE.
Part of	Product
Related to	ROLES CAPABILITIES VALUE
Set of	VALUE PROPOSITION COMPONENTS
Cardinality	1-n
Attributes	Name {abc} Description {abc} Illustrating Example {abc} OfferingRole {Role } ExpectedValueOfferingRole {Value} TargetRole {Role} PerceivedValueTargetRole {Value} Attributes inherited from Value Proposition Component

4 – Ontology element Value Proposition in VDAM based on Osterwalder's notation [14]

Following the logic of VDML, several views can be derived from the Value Proposition Exchange Diagram to support the operationalization of business models in one integrated approach. We propose the use of the following types of diagrams:

- Capability Management Diagrams to describe the capabilities necessary to offer a specific Value Proposition.
- Network Activity Diagrams to design the key meta-processes necessary to offer specific Value Propositions whereby activities need capabilities to be realizable.
- Measurement Dependency Graphs to display the logic of value creation and value contribution.

Consequently, these diagrams allow for a deeper understanding of the collaborative value creation between Roles and thereby supporting the operationalization of business models.

The creation of this role-based view of a market facilitates a number of applications by linking Roles to Actors, e.g. the own

business, partners, competitors or other stakeholders, all leading to a more informed decision towards the implementation of new business models. Using the top level view of Value Proposition Exchange Diagrams as a frame of reference and linking abstract Roles to a company enables a precise positioning of the existing business model or the business model idea. In addition, this positioning provides the opportunity to detect Roles which have not been considered yet or the detection of considered Roles which do not fit the value creation process in the market. Linking Roles to potential competitors facilitates identifying contested spots and less competitive spots which can include promising business opportunities.
Using more detailed views, fit between existing and necessary capabilities can be established and decision towards partnerships or knowledge buildup can be made. Additionally, key meta-processes can be analyzed and defined. Furthermore, a deeper understanding of Roles, Value Proposition, Capabilities and Activities and their impact on value creation can be created.

4. THE CASE OF FAST CHARGING INFRASTRUCTURE IN GERMANY

We applied our proposed approach in the area of fast charging infrastructure in Germany, thereby evaluating the designed artifact VDAM [7]. We chose this emergent market in the area of electric mobility because we deem it as a good example for the challenges of many of today's transforming or emergent industries:

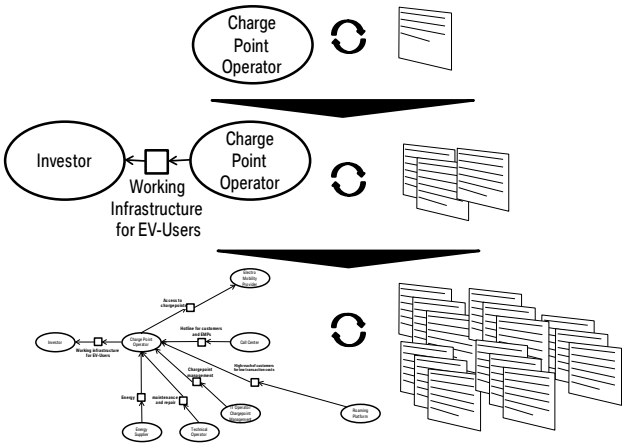
- Involvement of companies from diverse industry sectors, namely Automotive, Electro Technologies, Energy, and Services.
- Lack of a well- established value chain or value network and an ambiguous understanding of how value is created due to the novelty of this area.
- Deployment of several technological standards and proprietary solutions, namely CHAdeMO, Combined Charging System, and the Tesla system.
- Lack of a sound business case for the operation of fast charging infrastructure based on energy sales, due to high upfront investments and a limited willingness to pay. [11, 17]

Altogether, this creates a very complex and uncertain environment not favorable to direct investments and entrepreneurial engagement.

Using qualitative research methods we interviewed 17 senior executives and top experts from companies representing these different industry sectors, asking about their business models in and perspectives on this new field of fast charging infrastructure. Empiric data reveal a highly ambiguous understanding of how value is created and who is supposed to create this value. In addition, even when experts were talking about the same topics, the wording and terms of use were highly heterogeneous, complicating successful collaboration in this new field.[1] Applying our proposed approach to the empiric data gained in the interviews, we identified 21 different Roles that Actors can take on in the area of fast charging infrastructure in the electric mobility sector, as well as their corresponding Value Propositions. To comply with the requirements defined for this view in VDAM the methods of abstraction and differentiation were applied to the expert statements. Thereby we designed an unambiguous, normalized model of value creation in the area of fast charging infrastructure in Germany and described the elements in an ontology.

One of these Roles is called 'Charge Point Operator' (CPO). All experts mentioned this role but there were many different associations to what exactly this role is supposed to do and what value propositions this role is offering or receiving. Reason for this kind of phenomenon is the fact that the experts were talking about their own company or companies they work with which fill in this role. After analyzing the different expert opinions in detail it became apparent that the Role 'CPO' offers the Value Proposition 'working infrastructure for EV users' to the Role Investor. To explicitly describe the Role a first version of the ontology entity 'CPO' was developed.

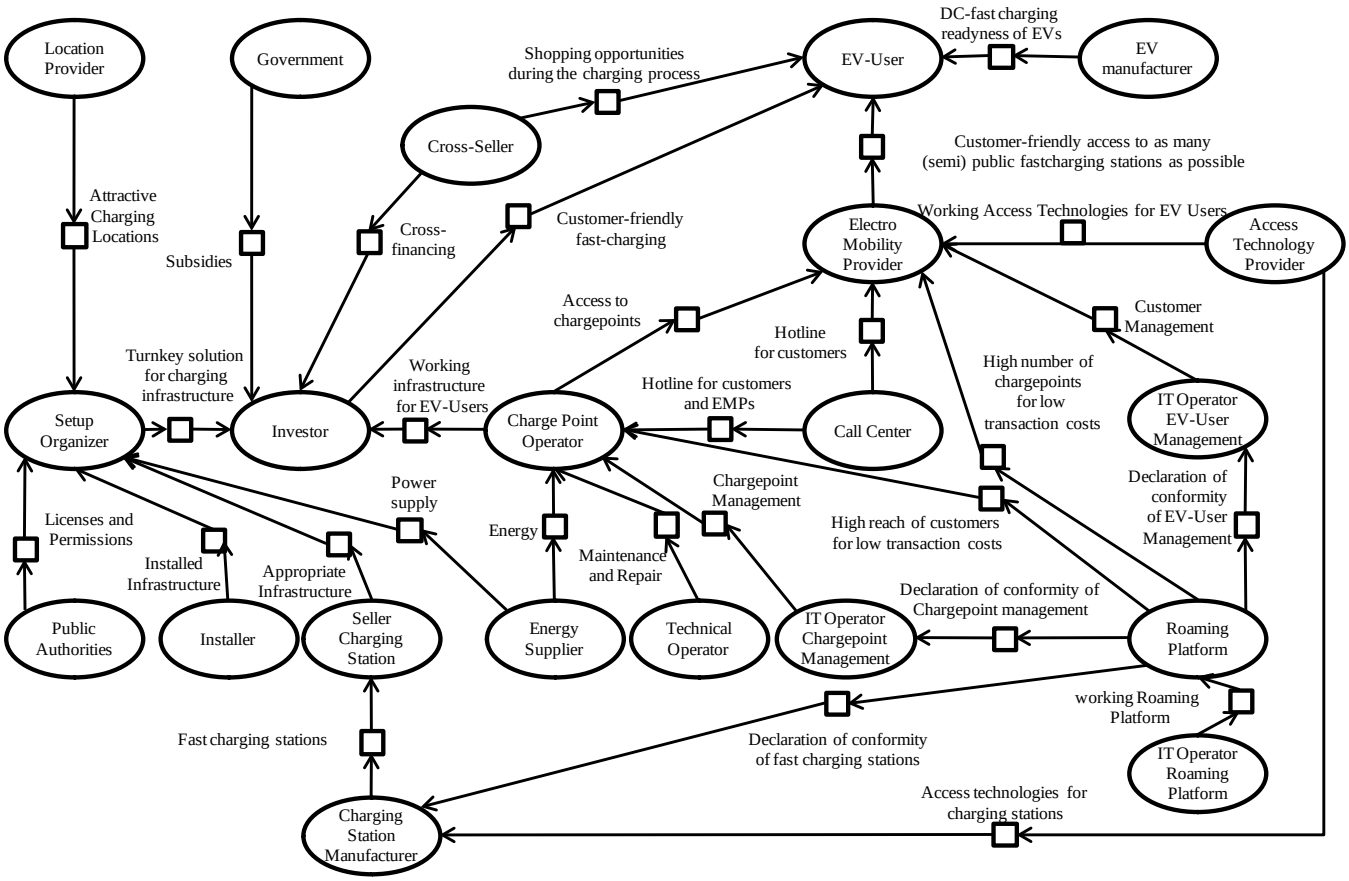
In the iterative approach of analyzing expert opinions and defining Roles and Value Propositions, the Value Proposition Exchange Diagram was constantly growing and changing (see Figure 5). Simultaneously, the corresponding ontology element of the Role 'CPO' became more detailed and other related ontology elements of Roles and Value Propositions were described, thus creating the desired unambiguous understanding of elements and value creation. In the case of fast charging infrastructure it becomes apparent that the Role 'CPO' is mainly organizing the actual operations of charging infrastructure by coordinating several Roles and their Value Propositions and offering the result to the Role 'Investor'. In addition a second Value Proposition 'Access to Charging Points' is offered to the 'Electro Mobility Provider' Role.



5 - Iterative Process of Visualization and Ontology building in VDAM

In several iterations we accomplished to map an unambiguous view of the complex value exchange and creation in the area of fast charging infrastructure in Germany (see Figure 6). The resulting view includes 21 Roles which Actors can fill and 29 Value Propositions which are offered by these Roles. The Value Delivery Exchange Diagram and the corresponding ontology allow for the deduction of the more detailed types of diagrams to

[1] Detailed results of the study will be published in Metzger, Kraemer and Terzidis, "A Systemic Approach to Business Modeling Based on the Value Delivery Modeling Language", in: Kuckertz et al. " Complexity in Entrepreneurship, Innovation and Technology Research, Springer Verlag Berlin, 2016



6 - Value Proposition Exchange Diagram of the Fast Charging Infrastructure Sector in Germany

support the operationalization of potential business models. In addition it facilitates several applications concerning analysis and development of business models. For instance, analyzing the Value Proposition Exchange Diagram and linking the Role 'CPO' to Actors, namely the companies interviewed, a number of conclusions can be derived:

- The Role is highly interconnected with other Roles and has a central position in the value network.
- The coordination of several roles does create and add value.
- Seven of the interviewed companies say that they fill in this Role and another four mentioned that they consider a company that fills this role as a strategic partner.
- All companies from the Energy sector fill this Role
- All except one company which fill the 'CPO' Role also fill at least one of the Roles directly related via a Value Proposition.

Altogether we can conclude that the Role 'CPO' is an important Role in the value network and is highly competitive. Especially companies from the Energy sector claim this Role because they also fill some other closely-related Roles.

5. DISCUSSION

As shown above, VDML seeks to fill the gap between strategy and business processes, supporting the operationalization of business model ideas and innovation. The development of an ontology supports the creation of common understanding between all parties involved in the design process and assists the operationalization of business models. This is of special importance for business modeling in industry sectors with high levels of uncertainty, the need of cross-industry collaboration, and a lack of common understanding, such as today's electro mobility sector. The combination of these two concepts with the implementation of an abstract perspective on value creation including the subsequent linking of abstract Roles to Actors proved to be a very useful approach for analysis and business model innovation and creation.

As shown on the example of the Role 'CPO', Value Delivery Architecture Modeling creates transparency and disentangles complexity, facilitating several applications in the emergent market of fast charging infrastructure in Germany:

- Creating an unambiguous perspective on how value is created including capabilities, key meta-processes and value contribution.
- Precise positioning of the analyzed companies in this complex value creation network and facilitating an enhanced understanding of their value creation and impact on value.
- Analyzing and comparing the business models of the companies described by the experts.
- The possibility to develop new business model ideas including a precise positioning in the value creation network including the definition of useful partnerships.
- Defining a collaboration model for value creation and business development for companies from different industry sectors, e.g. automotive, energy and electrical industry.

Market analysis, abstraction, visualization in diagrams and textual description in an ontology take some preparation and

development time. However, this front-loading results in distinctive advantages for business model innovation or creation for several reasons: First, these steps are a prerequisite to create a clear view on value creation including capabilities, key meta-processes and value contribution in uncertain and complex business environments. Additionally, competitor analysis deepens the understanding of potentials and threats of business model ideas. Finally, the Value Proposition Exchange Diagram enables top management to make fast but informed decisions on potential business model innovation or creation while a possible operationalization is supported by the underlying views and diagrams.

6. CONCLUSION

Based on the promising results of our study, we are confident that Value Delivery Architecture Modeling is valuable to researchers and practitioners. As the example above illustrates, VDAM can create transparency and clarity in complex value creation networks and thereby supports the description, development, and operationalization of business models within one integrated approach.

Reflecting on the situation, we observe that the proposed VDAM approach is particularly well suited for complex value networks as they appear in the example of fast charging infrastructure in Germany with 21 business partners and the corresponding complexity. This emerging industry is characterized by the necessity of a high degree of cross- industry collaboration to create value in networks. A paradigm shift in such a highly interdependent environment requires a common understanding of value creation and collaboration and the approach can help to create such an understanding.

Nonetheless, we are aware that the promising results of the application of the artifact VDAM need to be confirmed by future studies and research. Identifying additional opportunities and limitations will be of value to further validate and enhance VDAM. Therefore, and due to the novelty of VDML, we encourage additional application and validation in different business sectors. Of particular interest are applications in areas of cross-system transformation or emerging industries, as they repeatedly occur in the current economic environment.

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