Generating Business Models for Digitalized Ecosystems

Service-oriented Business Modeling (SoBM) - A Structured Modeling Approach

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Abstract: For various industries, Lucas et al. (2013) have recently described how intensely organizations, industries, society and the economy are transforming through digital technology implementation in products, services and institutions. Research is asked to find answers to the question of how to identify digitization opportunities, risks and costs. Furthermore, the leverage of digitalization opportunities with regard to customer's value-in-use, network perspectives, flexible remodeling of business operations and enlarging business model scope and scale needs to be addressed. Answers can only be found by respecting the distinct nature of digitality, which is a sound basis for generativity as well as evoking high complexity in product, services and network partnerships. The ongoing emobility as well as development of the smart home market can currently be seen as fields excellently demonstrating the enormous and creative potential of digital transformation. This makes it an ideal field of investigation to find answers to the proposed research questions. Taking the requirements of digitalization into account, the paper presents an approach for business model development evolved and tested in the field of emobility and smart homes. This approach is based on the principles of Service-Oriented Architectures (SOA) in combination with ideas of well-proven business modeling methods.

1 RESEARCH PROBLEM

Digital transformation is a phenomenon that has enormously changed the way we interact with our environment within the last decades. For various industries, Lucas et al. (2013) have recently described how intensely organizations, industries, society and the economy are transforming through digital technology implementation in products, services and institutions. As Lusch and Nambisan (2015) point out, digital technology plays a dual role as an enabler (operand) and initiator (operant) within the transformation process. It enables the creation of new value networks and facilitates the exchange of resources and knowledge within the network. In addition, digital technology is becoming increasingly part of new offerings through digitization of products and service. Even more digitization of products enables value creation through additional services having a combinatorial effect on the digital service ecosystems (Barrett et al., 2015). Based on these facts, some significant scientific attempt has been made to explain the challenges of digitalization and some steps have been taken to suggest how these challenges can be addressed. Nonetheless, there is still a lack of guidance on how to manage digital transformation successfully and the adoption or radical change of existing business models in the era of digitalization. Simultaneous digital transformation is attracting managerial attention and thereby digital business strategies are being set up, new business models are developed and tested to ensure companies' long-term survival (Bharadwaj et al., 2013).

2 OUTLINE OF OBJECTIVES

Not surprisingly, information systems science ranks research on business models and the impact of information and communication technology (ICT) on business models as a priority task. This task includes questions on ICT's transformative nature, the subsequent impact on industrialization as well as new product and service models. Furthermore, IT support for developing and managing business models is addressed by means of substantiation of conceptual models, graphical representations and the design of software tools for supporting business model development (Veit et al., 2014). Managerial

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perspective research should answer the question of how to identify digitization opportunities, risks and costs. Furthermore, the leverage of digitalization opportunities with regard to customer value propositions, remodeling business operations and enlarging business model scope and scale by identifying new customer channels and entering new markets needs to be addressed. Answers can only be found by respecting the distinct nature of digitalization, which is a sound basis for generativity as well as evoking high complexity in products, services and network partnerships.

The ongoing emobility as well as development of the smart home market can currently be seen as fields excellently demonstrating the enormous and creative potential of digital transformation. This makes it an ideal field of investigation to find answers to the proposed research questions. Taking into account the requirements of digitalization, a proposal for a new development approach for business model generation will be developed and evaluated in the field of emobility and smart homes. This approach is based on the principles of Service-Oriented Architectures (SOA) in combination with ideas of well-proven business modeling approaches (Chung and Chao, 2007; Newcomer and Lomow, 2005; Osterwalder and Pigneur, 2010).

3 STATE OF THE ART

The theoretical basis of this research is enabled by an extensive review of the literature on digital artifacts, digital transformation and business models. This supports the conceptual arguments and addresses the objective to derive insights into digital nature and its influence on business model development. Therefore, as an important precondition, the state of the art regarding the nature of digital artifacts and digital technology has been analyzed. Furthermore, the literature on digital transformation is evaluated to work out relations, impacts and opportunities for business models and business model generation. A general definition of a business model and its fields of application will be a conceptual basis for the case study research and the elaboration of a service-oriented business modeling approach. The presented outcomes of the first case study thereby (see section 6.1) focuses on the impact of digitization on business models and rely on digitization and digital transformation related literature. It utilizes a simple but effective business model classification scheme to evaluate digital technology's impact on development of business model opportunities within the emobility market. Second case study's outcome (see section 6.2) takes the findings of the first case study into account and presents based on the relevant literature a service-oriented business modeling approach.

3.1 Digital Artifacts and the Nature of Digitality

In this section, the distinct characteristics of digital artifacts, the layered modular architecture (LMA) of digital technology, the core design principles of digital technology as well as a definition for digital infrastructures will be introduced. This will be the basis for the definition of "digitalization" and help to back the understanding of digitalization of business models by providing an understanding and facilitating possibilities through form-giving structures of digitized physical products and services.

In the context of studying digital artifacts and technology, it is important to distinguish them from physical artifacts. With their theory on the nature and identity of technological objects, Faulkner and Runde (2013) presented a well-proven sound basis for identifying digital artifacts, their distinct attributes and design principles. They argue that objects are beside others, such as events and properties, basic kinds of entities. Regarding them as "structured continuants," they see objects as structured and composed of distinct elements. Technological objects are seen as a subset of objects that is specified by the function assigned to it by members of the human community. Technological objects can be separated into two categories, material and nonmaterial technological objects. The first possesses a physical mode of being, like office chairs and flipcharts, which have properties of location, mass, shape and volume. Nonmaterial technological objects have a nonphysical mode of being and thus are "aspatial." Nonmaterial, nonhuman technological objects are called syntactic entities and are composed of symbols that are formed by syntactic and semantic rules of the language in which they are couched. Examples of syntactic entities are research articles, product designs and bitstrings, such as computer files.

In sum, Faulkner and Runde (2013) present three criteria for nonmaterial technological objecthood: continuants combined with structure, an agentive function imposed by human communities and a nonphysical mode of being.

An important implication of nonmaterial technological objects is that they may be distinct from material and other nonmaterial "bearers". For instance, bitstrings as a collection of 1s and 0s as such have no spatial attributes and rely on material technological objects, like computers or other nonmaterial objects, like operating systems, to be usable. However, they possess a particular technical identity like material objects. Technical identity thereby depends on the community in which it is "used and/or appropriately referenced if (1) it has assigned to it the function associated with that technical identity, and (2) its structure is such that it is generally able to perform that function" (Faulkner and Runde, 2013).

Kallinikos et al. (2013) introduce four significant attributes of these technological nonmaterial objects that they describe as "digital artifacts qua objects". These attributes describe the specific nature of digital objects. Examining the ambivalent ontology of digital artifacts, Kallinikos et al. give a broad overview of the existing literature on the ontology and properties of digital artifacts within IS research, concluding that "digital artifacts are intentionally incomplete and perpetually in the making" and "[…] they lack the plenitude and stability afforded by traditional items and devices" (Kallinikos et al., 2013). Kallinikos et al. elaborate through their studies that digital artifacts can be distinguished from physical objects by their editability, interactivity, reprogrammability/openness and distributedness. The first three attributes concern the operations by which digital objects are put together (editability, interactivity, reprogrammability) and the last two the ecology of relations within which these operations are embedded (openness, distributedness).

Editability thereby concerns the possibility to change a digital object constantly by reorganizing the constituent elements, by deleting or adding new elements or by modifying individual elements of the object. Hereby, the logical structure that governs the object and the mechanisms of information production and processing are not interfered with.

Digital artifacts are interactive in the sense of offering alternative possibilities of a contingent nature to activate their embedded functions or to discover the encapsulated information items. Interaction does not need to invoke change or modification of the object. This is facilitated by the "responsive and loosely bundled nature of the items that make up digital objects" (Kallinikos et al., 2013).

Openness and reprogrammability of digital artifacts describe the accessibility and modifiability by other digital objects that are not the ones governing their own behavior. This means that the logical structure of digital artifacts can be modified by other objects than the ones that govern and manage the mechanisms of information production and processing. Thereby, openness is closely tied to the interoperable character of digital artifacts.

As the result of openness and interoperability, digital artifacts are hardly ever contained within a single source or institution. Thus, they are classified as distributive in the sense that they are transient assemblies of functions, information items or components disseminated over digital ecosystems. Insofar as they are not bonded to an obvious entity and in being distributed the existence of various combinations of digital objects of the same kind is possible. By this they are borderless, fluid and crucially transfigurable (Kallinikos et al., 2013).

Kallinikos et al. further argue that digital artifacts "are further supported by the modularity and granularity of the ecosystems in which digital objects are embedded". In this context, digital artifacts are from Kallinikos et al.'s point of view associated with the concept of modularity in means of objects being relatively independently organized in blocks that constitute a system by "a wider yet loosely coupled network of functional relationships". These blocks are mediated through interfaces that can serve a broad spectrum of functions. The granularity of digital objects refers to the ingredients from which blocks are made and describes "the minute size and resilience of the elementary units or items by which a digital object is constituted" (Kallinikos et al., 2013).

3.2 Digitization, Digital Technology, and the Layered Modular Architecture

Based on the presented theory of digital artifacts, digital technology can be divided into digitized and digital artifacts. The second one stands for nonmaterial, nonhuman technological objects that fulfill all mentioned characteristics of nonmaterial technological objecthood. Nonetheless, the combination of nonmaterial and material technological objects in the sense of e.g., an iphone application used on an iphone is a digital technology insofar as nonmaterial objects can be embedded into material technological objects. This technical process of embedding digital artifacts is called "digitization" and the results are called digitized artifacts. Consequently, digitized artifacts can be defined as the assemblages of digital and physical artifacts that are recognized as an end product to meet customer needs. Examples of digitized artifacts are everyday consumer products like mobiles and ebooks, but also a full range of industrial equipment, textile or car production robots. Digital technology will be furthermore understood as both digital and digitized artifact, which is seen as a structured and organized arrangement of material and nonmaterial technological objects consisting of computing, communication, interaction and information technologies (Henfridsson et al., 2014). Furthermore, digital technology can be used as an enabling medium for designing and providing digital services offerings (Chowdhury, 2015).

It should be emphasized that according to Yoo et al. (2010) the incorporation of digital objects causes physical objects to adopt the characteristics of digital artifacts (Yoo et al., 2010), whereby these digitized objects are characterized by distinct trajectories of material and digital artifacts, meaning that the entity no longer follows one unified line of development. Insofar understanding digital, nondigital systems as well as the management of decoupled systems increases the complexity of the development and maintenance of business models within digitalized ecosystems (Henfridsson et al., 2014).

Key enabler for digitization of technological objects is their so-called “layered modular architecture” (LMA) of digital technology. LMA facilitates the separation of material and nonmaterial entities. It maintains an interoperability among the components by a hierarchical dependence between the layers. The LMA can be described by four loosely connected but interdependent layers: device, network, service and content. The device layer contains two kinds of technological objects. First, physical hardware units like computer hardware. Second, nonmaterial objects like operating systems providing control and maintenance of the physical machine functionality as well as connecting interfaces to the network layer. Similar to the device layer, the network layer consists of material as well as nonmaterial technological objects, providing a sublayer for physical transport like cables and radio spectrum as well as a sublayer for logical transmission with nonmaterial objects like network standards. The service layer enables direct interaction with users through application programs featuring functionality, like creating or consuming content. The highest layer comprises data like text, sounds or images as well as metadata and directory information about e.g., content’s origin and ownership (Yoo et al., 2010). Following Yoo et al., predigital technology is featured by tightly coupled entities (such as books, analog telephone), or as in the case of purely physical or mechanical products (such as mechanical timers, powerlines, sockets) layers do not even exist. Digital technology facilitates through the separation of the four layers a free and individual design in between the different layer levels (Nylén, 2015). Digital technology is delivered intentionally incomplete with temporary bindings across the four layers. It is thereby following the procrastination principle, holding that a digital artifact “should not be designed to do anything that can be taken care of by its users” (Zittrain, 2008).

The open and dynamic breeding ground of digital technology, their catalyzing LMA, the fluid character of digital content and a rapid diffusion through the internet triggers unprecedented opportunities of generativity (Kallinikos et al., 2013; Zittrain, 2006). Generativity here refers to the “overall capacity of a technology to produce unprompted change driven by large, varied, and uncoordinated audiences” (Zittrain, 2006), which creates abundant opportunities for innovating products, services (Boland et al., 2007; Tilson et al., 2010; Yoo et al., 2010; Zittrain, 2006) and business models carrying out these innovations (Chesbrough, 2007) and themselves being influenced by the nature of digitality.

3.3 Digitalization

After having emphasized the distinct characteristics of digital artifacts, digitization and thereby the nature of digital technology as well as the generativity that is created by digital technology, there is a solid conceptual basis for understanding the impact and challenges for an industry facing digitalization. This phenomenon has recently been intensively discussed in applied managerial literature and science but surprisingly enough a commonly accepted or clear definition and understanding are still missing (Bounfour, 2016; Hanelt et al., 2015). Besides being mistakenly used as a synonym for digitization–which is, as already shown, a technical process of embedding digital technology into technological objects–it is often discoursed in context to digital transformation and digital innovation without clarifying the precise relationship between the notions.

Applied managerial literature tries simply to describe digital transformation as “the use of new digital technologies (social media, mobile, analytics or embedded devices) to enable major business improvements (such as enhancing customer experience, streamlining operations or creating new business models)” (Fitzgerald et al., 2013).

For sure, this is a shortcut in characterizing the effect of digital transformation by the underlying targets. More precisely, Tilson et al. (2010) characterize digitalization as “a sociotechnical process of applying digitized technology to broader social and institutional contexts that render digital technologies infrastructural" (Tilson et al., 2010). Consistently, Yoo et al. (2010) point out that by digitalization is meant "the transformation of sociotechnical structures that were previously mediated by non-digital artifacts or relationships into ones that are mediated by digitized artifacts and relationships. Digitalization goes beyond a mere technical process of encoding diverse types of analog information in digital format (i.e., 'digitization') and involves organizing new sociotechnical structures with digitized artifacts as well as the changes in artifacts themselves" (Yoo et al., 2010). Hence, the notion of digitalization includes the transformational nature of digitality as "a marked change in form, nature, or appearance" affecting individuals, firms, economies and societies (Lucas et al., 2013; Yoo et al., 2010) in part or as a whole by transformation of individual habits, organizational as well as operational structures through digital technology, including digital artifacts themselves. This can be characterized by a significant change in nature and focus of the business activities needed to acquire new capabilities or markets, and fundamental changes in tasks to leverage competitive advantages (Bounfour, 2016; Lucas et al., 2013).

Following this view, digitalization and digital transformation should be understood synonymously. By this, the differentiation between digitalization and digitization is underlined by highlighting the sociotechnical perspective, the processual character and the impact on social entities (consumers and producers) and institutions (organizations and markets). In addition, a thorough understanding of digitalization's influence on processes, organizational forms, relationships, user's product or service experience, market coverage, customers and the overall disruptive impact of digitalization is covered (Lucas et al., 2013).

Surely, conjured up by the distinct nature of digital artifacts, digitalization evokes generativity and thereby unpredictable combinations of products, services, ways of operating businesses as well as business models carrying out these combinations into a market, creating a good seed ground for innovation (Chesbrough, 2007; Henfridsson et al., 2014; Yoo et al., 2010; Yoo et al., 2012).

Innovation is "a new idea, device, or method," as well as "the act or process of introducing new ideas, devices, or methods" (Meriam-Webster dictionary). Insofar as one can follow that by digital innovation of a new idea, device or method enabled by digital technologies or the process of introduction, just these through digital technologies is meant (Yoo et al., 2012). However, an innovational character is a sufficient, but not necessary, condition to digitalization. This means that, from the perspective of the sociotechnical microsystem, every digital transformation is conjunct with a kind of novelty due to introduction of new technological artifacts, changing value propositions, operational processes or business model architecture. Nevertheless, an innovation has to cover novelty characteristics to the macrolevel. Digital transformation thereby is not forced to cover the characteristics of innovation. Digital transformation can also be performed by a sociotechnical process of introducing well-known digital technology or digitized processes into new fields of application.

3.4 Business Model Concept

With the dot.com era came a discussion about and on the concept of business models in science and applied science literature popular. Management scholars tried to find out how business works and how value is created, especially because billions of dollars had been spent on "business models" that later turned out to fail (DaSilva et al., 2014). Since then, researchers and practitioners have made a considerable number of attempts to define, describe and operationalize the business model concept (Fielt, 2014; Petrikana et al., 2015). Nevertheless, there does not exist a commonly accepted definition of business models and their conceptual components. Furthermore, the concept boundaries of application differ according to context and conditions (Fielt, 2014).

Following Fielt's comprehensive study on business model definitions and concept elements, a business model can be defined out of a generic and holistic point of view in the way that "[it] describes the value logic of an organization in terms of how it creates and captures customer value and can be concisely represented by an interrelated set of elements that address the customer, value proposition, organizational architecture and economics dimensions" (Fielt, 2014). This definition follows major and well-accepted focal firms' oriented research and practitioner streams (e.g., Chesbrough, 2007; Johnson, 2010; Osterwalder and Pigneur, 2010) explicitly focusing on customer value creation. It understands value delivery included in the value creation process, because "[the] separation of creating value and delivering value [is seen] as a supply-side perspective focusing on producers adding value. Customer (use) value cannot be created without involving the user and considering the use context" (Fielt, 2014).

Business model concept pays high attention on customer value creation and capturing while this value is viewed at least from two angles. From a supplier-centric point of view it is defined as a specific customer's (or a group of customers') contribution to a focal firm's profit. The value capturing elements of a business model include this view on 'value-in-exchange'. It is the value embedded in the product itself by adding value during the production process at the point of the exchange process. Briefly, it describes what the vendor gets from the customer.

From a customer-centric point of view value is defined by customers, based on their perceptions of the usefulness of the product or service on offer. This 'value-in-use' is set up through the execution of the value creation elements. It defines what the customer gets from the purchase in sense of the generated value with and determined by the user during the consumption process. Following this perspective, value-in-use is created by focal companies offering a "value proposition" and customers accepting the proposal and thereby realizing the proposal or value-in-use (Bowman and Ambrosini, 2000).

In general, a value proposition can be defined as a focal firm's promise to provide resources that create potential value within customer's activities. These resources can be a conjunction of economic, functional, emotional, social or technical components which usefulness depends on customers or beneficiary's perception (Mele and Polese, 2011).

As an instrument for strategic analysis and planning, business models are used to explain value chains or lately even more value networks from the perspective of a focal firm in an aggregated form. Further on, business models describe how activities are combined to execute a firm's strategy (Petrikina et al., 2014). Understanding a business model in this way, they can be seen as "reflections of the realized strategy" (Casadesus-Masanell and Ricart, 2010) and as what a company is actually delivering at a certain time. Therefore, business strategy and business models are closely interlinked as business models are part of the strategy work and execution (Demil and Lecocq, 2010). It is commonly accepted that a firm not only can use the business model concept for reasoning about different business models. Even more one or more different business models can be executed in coexistence within a company's strategic portfolio (Trkman et al., 2015). Thereby, a "business model as a model" is a relevant and useful "manipulable instrument" to help scholars and managers in reflecting what a firm does or could do to create and capture value. Furthermore, it can be used to change and manage its existing models to fit with changes in technology or market conditions (Baden-Fuller and Haeflinger, 2013; Spieth et al., 2014).

Representations of business models are widely used tools for analyzing and developing new products, services as well as value creation and capturing in detail. Besides other modeling tools, the Business Model Canvas (BMC) of Osterwalder and Pigneur (2010) can be considered as a popular and well-known representative business model. It is a holistic and easily applicable tool to develop, analyze and innovate business models of new and existing businesses. However, BMC fails to capture essential aspects of digital technology, such as recombination, interoperability and distributiveness. Furthermore, it is applicable for development of new business models but conceptually misses reusability and further utilization through recombination of existing value creating and capturing services. The business model description often remains superficial and detailed cost structures are rare. This makes continued use of BMC in operationalization of business model integration impossible or considerably more difficult. Last but not least, business model evolution in the sense of building new business on existing models seems not to be appropriately considered within the BMC concept (Fielt, 2014; Zolnowski et al., 2014).

4 METHODOLOGY

The research is based on design science (Hevner et al., 2004) and the design science research methodology (Peffers et al., 2007). Therefore, a series of case studies will be conducted to gain insights into the research problem and to evaluate the developed artifacts. Two have already been executed. The first is with a provider of electric vehicle services, the other with a provider of a smart home platform. Following a problem-oriented approach, the first case study is based on an enhanced business modeling approach to identify the relation between digitization and digitalization within the emobility market setting. Furthermore, influences on business model development and possible modeling support in digitized ecosystems are considered.

The case study was conducted in autumn 2015, including a set of workshops. These were focused on investigating new business models for emobility products and services deployment based on electric vehicle supply equipment (EVSE) and digitalization opportunities. In the first step, the deployment of EVSE at the industry-partner side was analyzed from early 2009 up to mid-2015 utilizing an adoption of the BMC method (Osterwalder and Pigneur, 2010). The used adoption of BMC was focused on an elaboration of general services and infrastructure (physical, personnel and digital) relations as well as the related value proposition evolution over time. This was meant to be the starting point for future business model development.

Utilizing an intensive literature review, the study was designed to test the idea of digital technology enhanced service identification and the derivation of business services fulfilling "unknown" customer needs in business model development. Within the demonstration phase and the following evaluation, key ideas of utilizing the SOA concept for enhancing business modeling were identified and transferred to a design update. This was fundamental for the next research phase and a case study with a provider of smart home platform services.

Taking the findings of the first case study into account, the second case study was conducted in winter 2015 based on an enhanced business modeling approach using the SOA concept as a significant methodological improvement. The results are under analysis and will be presented later this year. Nevertheless, a first comprehensive outlook will be given in Section 6 presenting a Service-oriented Business Modeling (SoBM) approach as a solution proposal for business modeling in digitized ecosystems.

5 EXPECTED OUTCOME

Within the ongoing emobility and smart home market development, a research approach has been set up to deliver results regarding five aspects: First, to analyze digital transformation by studying the influence of digitized technology within development of emobility and smart home markets. Second, to identify thereby a structured approach for developing business models within digitalized ecosystems based on IT-enabled service detection. Third, to provide an adaptive business modeling toolset enabling business development and visualizing business models as a decision support tool. Fourth, to elaborate a process model for continued business development supporting running businesses. Fifth, to apply this approach in the form of case studies within the emobility and smart home markets, testing usability and performance of the approach in business model evolution.

6 STAGE OF THE RESEARCH

As described above, the research has already passed two iteration phases. Therefore, the results of the first case study can be presented with regard to identifying derived requirements of a digital nature on business modeling. As the case study had an exploratory character, the study also delivers results regarding the development of the emobility market and the influence of digitality. These will also be presented. As an outlook in the second step, the SoBM as an outcome of the second case study will be presented comprehensively as a basis for discussion.

6.1 Digitization and Business Models

As a first research outcome a generic classification of digital artifact integration in EVSE (see figure 1) and resulting possibilities for business model generation as emobility service provider (EMSP) was presented (Pfeiffer and Jarke, 2016).

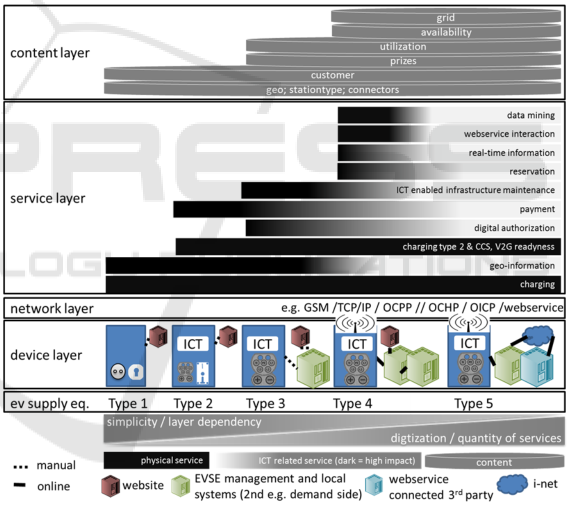

Figure 1: Electric Vehicle Supply Equipment (EVSE) Layered Modular Architecture–own diagram.

Reflecting the emobility market situation up to 2015, EMSP business is defined as a combination of charging-services operators' (CSO) and charging-services providers' (CSP) business. An EMSP thereby is a company running its own EVSE network and providing charging and information services for EVs regardless of whether they provide these services within their own or in foreign EVSE networks. By delivering these services, they create value for EV B2C and B2B users and in value chains through B2B2C network business. The study results strongly support the assumption that within digitalized market settings, EMSP value capturing and business model sustainability is highly reliant on the grade of digitized technology used and digitalization within the business model itself.

The paper examined the opportunities of digitzed technology for business model development and business transformation (see figure 2). The basis was an in-depth analysis of the historical development of ICT-enhanced infrastructure in the emobility charging market. Originating from the digitization of EVSE, five generic business model types were conducted and analyzed. In a first step, the LMA service layer's digital technology-based services were transferred into a business model description. Value creation as a core element was described by core business process service elements. Further on, value-capturing opportunities and business model evolution prospects were deduced based on the elaborated business process services. Value capturing was therefore categorized into a revenue model, business scope and scale, as well as OPEX and CAPEX of the business model.

		business model	simple	simple+	medium	high	high+
		charge point technology	Type 1	Type 2	Type 3	Type 4	Type 5
		ict application	www	www	www, CPMngmt	www, EVSE mngmt, intraconnected, dsm	www, EVSE mngmt, interconnected, dsm
value creation	physical service	charging	+	+	+	++	+++
		charging type 2 & CCS	-	+	+	++	+++
		EVSE deployment	+++	+++	+++	+++	+++
		maintenance	+	+	+	++	+++
		customer handling	+	+	+	++	+++
	ICT related basic services	geo-information	+	+	+	+	+++
		digital authorization	-	-	+	++	+++
		webservice interaction	-	-	-	+	+++
		digital guided maintenance	-	-	-/+	++	+++
		reservation	-	-	-	+	++
		market place connectivity	-	-	-	-	+++
		realtime info (CP/ charging)	-	-	+	+	+
	ICT related comfort services	payment model flexiblity	-	-	+	++	+++
		legal informational require.	-	-	+	+	+++
		remote control	-	-	+	+	+++
		dynamic pricing	-	-	-	+	+++
		smart grid integration	-	-	-	+	+++
		demand side mngmt	-	-	-	+	+++
		V2G	-	-	+	+	+++
		seemless customer handling	-	-	+	++	+++
value capture		revenue model	flat	flat	flat, usage-based	flat, usage-based	flat, usage-based, direct, 3rd-party
		revenue model flexibility	low	low	medium	high	high
		business scaleability	low	low	low	medium	high
		business scopeability	close	close	medium	medium	high
		CAPEX (EVSE / location / ICT)	-/-/-	+/-/-	+/-/+	+/-/+	+/-/++
		OPEX (EVSE / location/ ICT)	+/+/-	+/+/-	+/+/+	-/-/+	-/-/+

+ fulfillment
++ 3rd party no direct interaction
+++ direct handling 3rd party

inflexibility of business model

integrativity
fulfillment of customers needs

Figure 2: Generic Emobility Service Provider business models-own diagram.

The analysis showed that basic customer needs–charging services–can be fulfilled by any of the EVSE-based EMSP business model approaches. However–from the customers' perspective–the quality of service and value-added services (e.g., real-time geoinformation) as well as the flexibility of payment and contractual models rises by using digitized EVSE equipment. These effects are ceteris paribus accompanied by higher CAPEX for investment into ICT (EVSE and backend systems). Further, by implementing EVSE type 4 and higher technology, lower OPEX can be achieved through digitally optimized manual processes, e.g., by preventive maintenance or remote assistance.

From the industry partners' perspective, the higher investment in digital EVSE technology and ICT backend systems thereby can be significantly compensated by minimizing manual services processes in the field. In addition to the just mentioned values for customers' quality and flexibility perception and business models' cost structures, further benefits can be achieved. Digital technology-based service enhancement enables higher flexibility of the revenue model (e.g., usage-based tariffs, geoinformation services for third parties) as well as a higher scalability and scopability of the business model itself. As EMSP business models are operating in the emobility market, there are various opportunities for promoting value-added services in the transport and energy market. This underlines the assumption that the digital nature makes product and service boundaries become fluid (Yoo et al., 2010). In the current case, it descends as the digital offspring of EVSE type 5's digital nature. This type of "charging system" is creating unprecedented possibilities for product and service innovation e.g., by promoting services in the energy and transport system (e.g., information services and smart-grid services). The later stages of developing type 5 technology enable an enrichment of EMSP business models by promoting new services based on already existing technology in the field. Furthermore, it has to be stated that the digital nature obviously can make its generativity significantly stronger through implementation of open, accessible, interoperable and interconnected technology following the LMA architecture model bringing the layers' borders. To safeguard the business model's sustainability and create a future-proof setup, industry partners' experience suggests strongly that ICT should be embedded at least with state-of-the-art technology acknowledging the LMA. This means to force layer independence, which is not regarded within EVSE for types 1 to 3. In the current case, it is an interconnected infrastructure setup as in types 4 and 5 EVSE based on webservice technology. It has been experienced that it is highly costly and inhibits quick-to-market strategies with solid blocks of soft- and hardware. Even more practice has shown that dump EVSE as well as closed-shop infrastructure systems (up to EVSE type 3) lower business model development possibilities by forcing high changing cost at EVSE deployment sites accompanied by high complexity of managing the different trajectory paths of digital and physical technologies in the field.

This study is exploratory in three senses. Being based on the expert knowledge and experiences of a pioneering company in the young field of emobility, it provides an overview on digital technology and business development since 2009. Thereby, insights from digital technology's influence on business deployment over time are gained. This provides a fertile ground for deducing learning for future business generation in the emobility market at a highly digitized point of intersection between smart transport and energy markets.

Furthermore, it demonstrates the generative character of digital technology and the exploratory design of LMA utilized as a basis for an advanced business modeling in digitized market settings. Applying the LMA's "service layer" within businesses' value proposition design, unprecedented possibilities are generated by digitality becoming visible. Thus, e.g., already identified customers' issues can be solved (e.g., "Is the EVSE I'm heading for available?," "I want to pay-as-I-go!") or customers' needs that they do not even know (e.g., "Energy price optimization by energy market optimized charging") can be addressed by digital technology-based services. Using EVSE type 5 technology, existing digital services from other fields of application can easily be involved to solve these issues, which brings time-to-market and cost-structure advantages (e.g., use of Google maps and integration of PayPal payment services). Moreover, other fields of application and customers can be addressed, expanding the scope and scale of EMSP business models by detection of EVSE-based business services.

Last but not least, the observations indicate that business modeling approaches within digitized market setups should facilitate LMA and a service architecture-based approach to identify profitable value creation and capturing opportunities. Thereby, the generative nature of digitality can be leveraged and transferred into business models carrying digital artifacts into reality. Therefore, future directions of research will lead to the application of the "Service-Oriented Architecture" (SOA) concept into business modeling approaches to facilitate value identification through service-oriented business modeling. Taking advantage of thinking in "service repositories," value creation and capturing in existing and new fields of business seem to be promising approaches in digitalized market setups. The SOA concept is strictly based on the principles of modularity and granularity. These are fundamental elements of digital nature's generative matrix, enabling better maintenance and development of existing business models as well as the exploration of business network partnership by using well-proven SOA methods.

Because of its exploratory character, the study was limited in several aspects by focusing on EVSE technology and analyzing EMSP business models. Thereby, simplifications regarding automotive and energy market integration were applied. For instance, the analysis was conducted reflecting the grid and EV as "black boxes" with interfaces to use EVSE as a physically connected point of grid and EV to deliver and acquire possible services and vice versa. Besides this digital technology, like battery management systems, smart grid management systems, navigation systems or mobile smartphone applications were assumed as ways to interact with the infrastructure but not being part of the investigation. Furthermore, customer's willingness to pay for quality of service and value-added services was not part of the investigation as well as strategic issues regarding customer accountability in B2B2C relationships were neglected. Last but not least, data security and privacy as well as regulatory requirements should be examined in further research.

6.2 Service-oriented Business Modeling - Proposal for a Solution of Business Modeling in Digital Transformed Ecosystems

As described above, digital technology offers unprecedented opportunities for value creation and capturing within digitally transformed ecosystems. Furthermore, the development of new products, services and product service systems has to follow the distinct nature of digitality. This nature has been characterized as interactive, interoperable, networked, borderless and fluid. Digital infrastructure creates a highly flexible, complex and networked ecosystem. Following the concept of a LMA, digital technology's data and service layers can be utilized as a starting point for business development by being transformed into new business services carrying digital technologies' value proposition into sociotechnical systems.

Taking the nature of digitality into account, the SOA concept seems to deliver compatible components for analyzing, developing and executing business models in digitally transformed ecosystems. Core elements of SOA are highly reliant on digital artifacts' characteristic modularity and granularity. Furthermore, SOA's design principles of modularity, loose coupling and standards foster digital technology capabilities: reusability, distributiveness and interoperability (Luthria and Rabhi, 2015; Mueller et al., 2010).

Based on this perception the idea was born to propose a business model development concept that takes the advantages of SOA into account. Thereby a practical-oriented concept should be developed to exploit the opportunities of LMAs as well as to master chances and issues arising from the digital transformation of ecosystems. Following this thought a case study was conducted to test, to further elaborate and to improve the approach. The resulting procedure model, development cycle and finally the SoBM concept will be subsequently presented.

SoBM Procedure Model. The development approach (see figure 3) is structured as follows. Based on the conviction that digital product and service development in particular has to be derived from customer's value-in-use, partner-related expertise and IT-enabled perspectives, an analysis of the ecosystem and technology opportunities is the starting point for the procedure model. Needless to say, a good market knowledge, the ability to identify and involve network partnership and an intense knowledge of information systems and processes is key to sustainable digital transformation of business models. Therefore, the analysis elaborates distinct market structures, value chains and networks, as well as market partners' objectives.

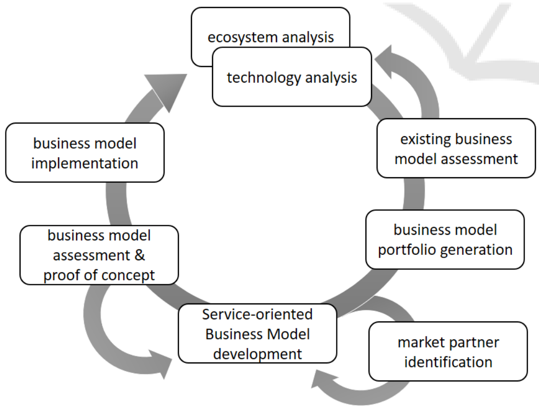

Figure 3: SoBM Procedure model–own diagram.

Either based on the ecosystem analysis or on a digital technology's LMA service layer exploration, a company assessment is iteratively conducted to identify possible market positions and value propositions. The company assessment is based on an existing structured business model (SoBM) description identifying possible value creation opportunities by utilizing business service identification based on either digital technology (LMA) or customer needs as well as competitors' value proposition-based identification methods.

In the next stage, the deriving portfolio of business models is assessed by its probabilities and profits. Afterwards, high-ranked business models undergo the SoBM development cycle (see figure 4), which will be described later as part of the SoBM. One key outcome of this process is a concrete service repository (see figure 5) related to the focal firm's value proposition and external customer as well as partner services. Having an elaborated SoBM based on service repository and a set of identified business partners, a second business model assessment stage can be conducted. Herein a proof of concept helps to assess business model's prospects. With a positive decision, the business model can be transferred by business model integration into the operational stage. Taking new or redesigned business into operations is starting point for a continuous business model improvement process.

Development Cycle and the Service-oriented Business Model. The core of the presented business model development concept is the layered SoBM. Essential element of the SoBM is a layered business model architecture. This is formed by a set of business, service and infrastructure layers for all business partners in different detail level. It takes shape within the SoBM development stages (see figure 4) by being completed and optimized through an iterative process defining layered business models for the customer structure, the focal firm and the value network partners.

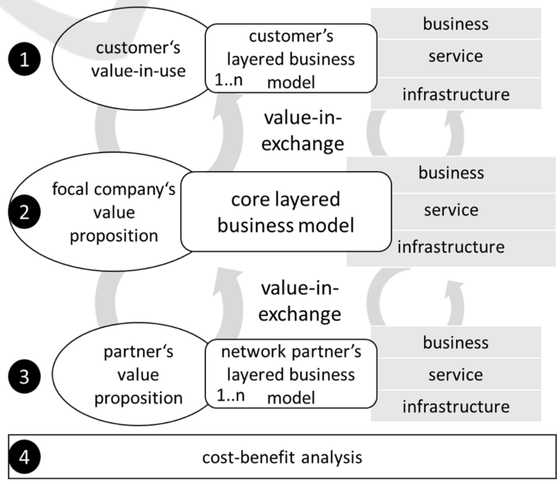

Figure 4: SoBM development cycle–own diagram.

Customer's layered business model development is focused on one or more customers' values-in-use, the associated revenue opportunities and customer's value context. Latter is formed by involved customers' services and infrastructures. These are formulated on specific layers to support the value-in-use focused focal business model development in the next stage.

Focal firm's layered business model is the core element of SoBM concept (see figure 5). On the business layer it defines focal firm's value propositions as an answer to the identified customers' needs. Furthermore, it includes firm's key activities corresponding to the value propositions. Means and methods required to carry out these activities are described on the service and infrastructure layer. The service layer is formed by a focal service repository. This value-in-exchange-oriented tool fulfills the function of organizing and utilizing all key activity bonded and value proposition relevant services. These services are categorized by business process services, as high-level abstract services, coordination services, atomic business services, whereby all service types can also be business or business-enabling IT services. Focal firm's services are of public domain when they interact with value network's or customers' services. Private services are executed within the firm. Services utilize firm's resources which are described on the infrastructure layer. These resources can be intangible, tangible/physical and personnel infrastructures each described with relation to the supported services. Intangible infrastructures are resources like IT-applications, business relations, (digitalized)

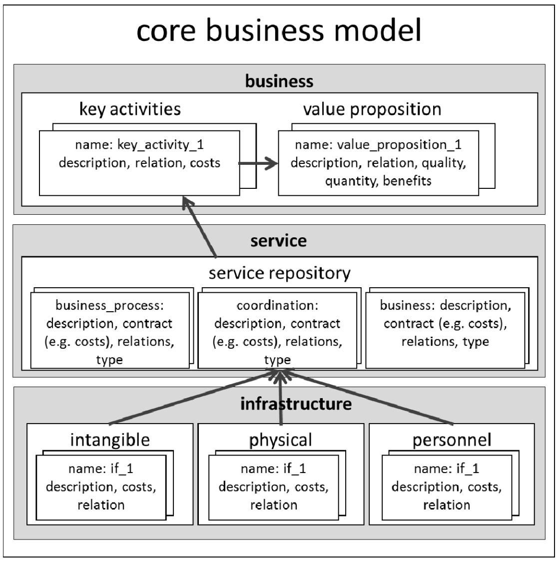

Figure 5: Core Business Model–own diagram.

information. These are enabler and initiator resources having high impact on business success in digitalized ecosystems. Physical resources are e.g. machines, IT-hardware, communication channels. Personnel infrastructures cover firm's organizational setup and human capital. Personnel infrastructure thereby models people's roles and contribution to the service repository with different skills and knowledge in their intra-organizational and inter-organizational boundaries (Mele and Polese, 2011).

In network partners' layered business models value propositions, services and infrastructure are represented on specific layers. These are derived through identification of relevant network partners' skills and contribution based on the focal service needs. Partner's business model elements are directly mapped to relevant components on focal firm's business and services layers. By this all necessary activities for fulfilling the value propositions are bundled within an interrelated service repository.

Finally, the financial aspects of the focal business model are analyzed in a cost-benefit analysis (Brent, 2007; Farbey et al., 1992). This analysis is based on the cost-architecture which can be derived from the service repository in conjunction with the value-in-use benefits described by specific revenue models within customers' layered business models. By applying financial values to the service repository, including external service costs, the cost structure of value creation and capturing is caught in a structured way. Benefits are modeled according to the customer structure by addressing financial values to customer's demand-side needs. Not measured within the service repository are nonfinancial costs and benefits. These are applied on the business layer level according to the value propositions. Thereby, an overall criterion for decisions on business model implementation is given. This is not solely built upon financial, but further on other economic, ecological or social components. Other economic reasons are, e.g., the future-proof technological setup of a business model investment. A cost–benefit-oriented SoBM scenario analysis based on service out- or insourcing as well as on service-specific digitization degrees support business model decision making within the business model assessment stage.

It has been shown that the SoBM concept is covering customers, value proposition, organizational architecture and economic dimensions. Thereby it is qualified to be a business model concept describing all relevant value creating and capturing elements (Fielt, 2014). By taking market/customer needs (value-in-use), focal propositions and service architecture as well as market/value partnership contribution into account it additionally encompasses a network perspective on value creation and capturing.

Further on, the SoBM concept presents a comprehensive, reusable and digitization-oriented way of business modeling in digital transformed ecosystems.

The modeling approach is comprehensive because value creation and capturing can be described on a holistic basis for the whole value network connected over all SoBM layers and being orchestrated within a coherent service repository. In addition, through the connection of value propositions and service repository elements, value creation and capturing within the business model is underpinned with clarifying content. Last but not least, service as well as infrastructure layer provide an interconnected value context.

The modeling approach is reusable because SoBM concept is not only covering business development aspects but even more it is a basic tool for supply-side and demand-side tendering procedures and for creation of new value network partnerships. Besides this, existing internal or partner's public service repositories can be used as a starting point for new business development based on existing business models and business partnerships (Löhe and Legner, 2009). Moreover, SoBM enables the execution of business models by providing an elaborated "ready-to-use" service repository with clear and measurable preconditions.

The modeling approach is digitization-oriented because it utilizes digital technology's LMA within the SoBM development process to assess and generate new value-in-use applications. This fosters the use of digital technology as an operant in new business development. Further on, it enriches the service repository with optimized IT-enabled services and thereby unlocks operand capabilities in new or redesigned business models. On top of that the utilization of the SoBM concept warrants alignment with business partners service (IT- and non-IT related) fulfillment from the scratch by taking partners service repositories into account. Within the SoBM development cycle this allows to use "uniform means to offer, discover and interact with, and use capabilities to produce desired effects consistent with measurable preconditions and expectation" (Demirkan and Goul, 2006). Within the implementation phase the usage of a service repository allows an IT-oriented implementation based on existing SOAs. By this SoBM proposes to enable a more flexible, faster, flawless and cheaper implementation of IT-related services.

Overall SoBM structure facilitates digital artifacts intentionally incomplete and perpetually nature to trigger unprecedented possibilities of business value generation. By following the nature of digitality and it transposes the concepts of modularity, granularity, interactivity, openness and distributiveness into business model's architecture utilizing the SOA concept and focusing on network effects as well as on the value-in-use at the customer side.

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