Evaluating the Design of Service-Dominant Business Models: A Qualitative Method

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Rick Gilsing[*1], Oktay Turetken[1], Baris Ozkan[1], Paul Grefen[1,2], Onat Ege Adali[1], Anna Wilbik[3], Frank Berkers[4]

Abstract [†]

Background: *Driven by factors such as digitization and rapid technological change, many contemporary organizations adopt a service orientation to sustain competitiveness and to improve their value propositions to customers. In doing so, organizations typically engage in collaborative service ecosystems to co-create value and exchange services, and conceptualize such collaborations using business models. The resulting models should be evaluated to support the development of service ecosystems and their long-term viability. Despite academic efforts on the evaluation of traditional, organization-centric business models, limited research is present supporting the evaluation of service-dominant business models, taking into account their key characteristics, such as service exchange and value co-creation in business networks.*

Methods: *Following a design science research methodology, we have iteratively designed a method addressing the qualitative evaluation of service-dominant business models, building on and integrating the theory on service-dominant logic, business model design and business model evaluation. To structure the steps of the design process, we leverage a situational method engineering approach, following a paradigm-based strategy. To evaluate the validity and utility our method, we have applied it to a real-life business case in the mobility domain, involving eight industry stakeholders in the process.*

Results: *The method constitutes a set of guiding questions and a procedural description of their use, addressing the evaluation concerns of feasibility, viability, structural validity and robustness with respect to the service-dominant business model. The results of the evaluation demonstrate that the use of the method facilitates users to reflect qualitatively on design decision with respect the business model design and offers insights on its expected performance.*

Conclusions: *This work contributes to extant research on service system engineering and the instantiation of service-dominant logic, clarifying how service ecosystems can be evaluated through the business model concept and explicating how business models are influenced through service-dominant logic.*

Keywords: Service-dominant Business Model, Service Ecosystem, Business Model Evaluation, Design Science Research

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[†] ***Author version*** *of the paper accepted in Pacific Asia Journal of Association of Information Systems (PAJAIS) 20 March 2021*

1 Introduction

We are witnessing the rapid evolution of many markets into highly interconnected and dynamic business environments, driven by factors such as rapid technological change and digitization (Engel & Ebel, 2019). Although this development offers contemporary organizations novel opportunities to create value through the use of digital technologies and data analytics (Ostrom, Parasuraman, Bowen, Patricio, & Voss, 2015), it also forces them to deal with increased competition, as the boundaries of markets become vague or even entirely dissolve (Lübbecke & Picot, 2015). In response, we observe that many organizations adopt a *service-orientation* to sustain competitiveness, to seek novel sources of value creation and to foster long-term relationships (Kowalkowski, Gebauer, & Oliva, 2017). The implications of such a shift in dominant business logic are often characterised as a shift from a *goods-dominant logic* to a *service-dominant logic* (SDL) (Vargo & Lusch, 2017), conceptualizing how value is created for customers through services (Grönroos, 2011).

To provide coherent service solutions to customers and to reduce the resulting complexity of such typically customized offerings (Briscoe, Keränen, & Parry, 2012), organizations often engage in collaborative *service ecosystems*, in which services are exchanged to co-create value (Böhmann, Leimeister, & Möslein, 2014; Vargo, Maglio, & Akaka, 2008). We observe that such service ecosystems are increasingly prevalent in the modern business landscape. For instance, contemporary service providers such as Netflix or Spotify leverage platforms to bring together a set of network partners (such as licensors, music / movie makers and data warehouse providers) to offer highly customized video or music services to the end-customer (Täuscher & Laudien, 2018). Similarly, in the mobility domain, we observe the formation of service ecosystems to address mobility challenges (such as improving traffic efficiency or reducing environmental pollution), involving the integration and concurrent use of services of government bodies, technology providers, road operators and logistics providers (Abdelkafi, Makhotin, & Posselt, 2013; Gilsing, Turetken, Grefen, & Adali, 2018; Grefen, Turetken, Traganos, den Hollander, & Eshuis, 2015).

To understand the appropriate configuration of new service ecosystems, the *business model* concept is frequently used to describe the business logic and structure necessary to create value (Blaschke, Riss, Haki, & Aier, 2019; Clauß, Laudien, & Daxböck, 2014). In contrast to more traditional *goods-dominant* business models (describing the working of a single organization), the resulting *service-dominant* business models adopt an explicit networked perspective, explaining how organizations collaboratively co-create value through service exchange. As business model designs serve as the starting point for further implementation of business initiatives into business processes and IT (Veit et al., 2014), and considering that such service-dominant business models possess different characteristics as opposed to traditional models, this calls for support and guidance on the design and evaluation of *service-dominant* business models to support decision making and to ensure novel service ecosystems are valid and viable. Failure to do so may have significant implications for the long-term viability of such ecosystem designs. For instance, in the mobility domain, research has shown that the success of service based solutions such as car sharing or intermodal mobility can severely be impacted by a lack of understanding of the logic by which value is co-created and the drivers of stakeholders involved (Schulz, Böhm, Gewald, Celik, & Krcmar, 2020; Schulz, Gewald, Böhm, & Krcmar, 2020), issues that can be resolved through practices of evaluation.

Although previous research has focused on the development of tools and techniques to support the *design* of service-dominant business models (Turetken, Grefen, Gilsing, & Adali, 2019; Zolnowski, Weiß, & Böhmann, 2014), we see that limited work has focused on the *evaluation* of *service-dominant* business models. Particularly in early phases of business model design and innovation, uncertainty is significant (McGrath, 2010) which as a result can strongly impact or complicate business model design decision making (Schrauder, Kock, Baccarella, & Voigt, 2018). It is argued that such uncertainty in early phases of innovation can be reduced through *qualitative* evaluation tools and support (Tesch & Brillinger, 2017). However, examining existing work on the qualitative evaluation of business models, we observe that although tools and methods have been proposed that focus on the assessment of organization-centric business models (Haaker, Bouwman, Janssen, & de Reuver, 2017; Mateu & Escribá-Esteve, 2019), to our knowledge no work has focused on supporting the qualitative evaluation of *service-dominant* business models. Such evaluation support calls for a holistic, networked

consideration of value co-creation, grounded on the principles of SDL to fully address the characteristics of service ecosystems. Therefore, to further support development of service ecosystems, and to support decision making on the design and evaluation of the business models that explain such systems, we pose the following research objective:

'To develop a method to support the qualitative evaluation of service-dominant business model designs'

Accordingly, in this paper, we propose a method for the evaluation of networked business model designs through the lens of SDL. The method encompasses a set of guiding questions, inferred from SDL and catered to business model evaluation, as well as a procedural description of their application. Application of the questions should aid practitioners to evaluate design decisions with regards to a service-dominant business model and should help them better understand the performance or qualities of the business model in terms of its *viability, feasibility* and *robustness*.

To guide our research process, we followed the *design science research (DSR)* methodology (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007). To structure the steps taken to iteratively design the resulting artifact in the design phase of the DSR process, we followed the *situational method engineering approach* (Ralyté, Deneckère, & Rolland, 2003). We have introduced an initial version of this method in Gilsing, Turetken, Ozkan, Adali, & Grefen (2020), explaining the set of guiding questions that constitute our method. However, this initial version lacked formal evaluation in real business settings and offered limited handholds with regards to its application. In response, we have evaluated the validity and utility of the method by applying it a real-life business case in the mobility domain, and by conducting semi-structured interviews with the stakeholders involved in the case. We discuss how the application of the method in this business case supported decision making with regards to the business model blueprint design, and how users perceived the utility of the method. Moreover, in this paper, we present an explicit procedural description that clarifies how and when the set of questions should be used.

The proposed method contributes to research on supporting the design and development of service ecosystems, presenting a novel method to support their evaluation, in turn aiding their systematic development (Böhmann et al., 2014). In addition, our work offers empirical evidence for the application of SDL in business settings, contributing to its further instantiation (Schulz, Gewald, et al., 2020; Vargo & Lusch, 2017). For practice, our method offers a means to evaluate design decisions with regards to service-dominant business models and to create an understanding of its expected performance in the early phases of business model innovation and in later phases when its design changes.

Our work is structured as follows. Section 2 discusses the background to this research, and the related work has already been conducted. Section 3 discusses our research design, elaborating on the steps followed to develop and evaluate our artifact. Section 4 describes the proposed method and details how the questions have been derived. In Section 5, we illustrate the application of our method by means of the real-life business case to evaluate the validity of the method. In addition, we describe the procedure followed for the utility evaluation of the method and the results obtained. We conclude our research work in Section 6, describing the main implications of our research, its limitations as well as the avenues for future research.

2 Research background and related work

In this section, we discuss the research background and related work to our study. Specifically, we discuss the *service-dominant logic* paradigm as well as elaborate on *service systems engineering*, dedicated at supporting the design of service ecosystems. Next, we discuss the concept of *service-dominant business models* and existing work that supports their design. Lastly, we detail *business model evaluation* and what related work has been conducted in this domain.

2.1 Service-dominant logic and service systems engineering

Service-dominant logic (SDL) is a research paradigm originating from marketing that takes *service* as the basis for exchange and the means towards value creation, and is often considered as the successor of the traditional *goods-dominant logic* (Vargo & Lusch, 2008, 2017) In contrast to GDL (which considers value to be embedded in manufactured products or goods), SDL considers value to be solely

determined by the beneficiary, which as a result significantly depends on the context in which the beneficiary generates or appropriates this value (Grönroos & Ravald, 2011). It is argued that organizations can shape this context through providing *service* rather than through the provisioning of products. Through service, organizations are able to better support the resource integration and subsequent value creation processes of a customer, thus being able to better cater to the needs of the customer. As a result, the focus is on offering complete, holistic solutions rather than stand-alone products. In this light, products and commodities may become part of the mechanisms to provide such service-based solutions.

SDL takes two components at its core, namely *value co-creation* and *service ecosystems* (Vargo & Lusch, 2016). Here, *value co-creation* is directed at clarifying the process by which value is co-created through resource integration and or interaction between the service offer(er) and the customer or beneficiary, as well as the mechanisms and processes that may underlie this process. Here, organizations should consider for novel service solutions in what way the *provider sphere* (e.g., the value proposed, established through offerings) and *customer sphere* (value-in-use through use of the offerings) are configured and how these should be catered to best address the needs of the customer (Grönroos, 2011). On the other hand, *service ecosystems* describe the configuration or structure by which actors exchange services and co-create value, offering the blueprint or architecture through which the logic of value co-creation and capture can be explained (Akaka & Vargo, 2014). Accordingly, service ecosystems provide the context (in terms of business networks) with regards to how actors collaborate and co-create value, for which actors may partake in multiple service ecosystems. In addition to *value co-creation* and *service ecosystems*, the concept of *service platforms* is used to describe the architecture for service exchange and resource integration, thus providing the foundation for value co-creation (Lusch & Nambisan, 2015). In light of digitization and rapid technology change, such service platforms can serve as a significant source of innovation through liquefication of resources. As a concrete example, in the mobility domain, smartphone applications serve as hubs for the exchange and integration of services between mobility actors such as mobility providers, logistics providers and government bodies (Schulz, Böhm, Gewald, & Krcmar, 2020). For our work, we focus on supporting the configuration and design of such service ecosystems and its interfaces to value co-creation and service platforms.

To further support the conceptualization of adopting a service-orientation, the implications of SDL have been summarized through a set of axioms (as described in Table 1), that capture its essence and foundation.

Table 1: Foundational axioms of SDL (Vargo & Lusch, 2017)

A1	Service is the fundamental basis of exchange
A2	Value is co-created by multiple actors, including the beneficiary
A3	All social and economic actors are resource integrators
A4	Value is always uniquely and phenomenologically determined by the beneficiary
A5	Value co-creation is coordinated through actor-generated institutions and institutional arrangements

Despite the fact that SDL is established in many research domains and conceptually clarifies how value is co-created in service ecosystems, it remains on a meta-theoretical level (Schulz, Gewald, et al., 2020; Vargo & Lusch, 2017), making it rather difficult to use in empirical contexts. In response, the research domain on *service systems engineering (SSE*) has focused on providing support towards the systematic design and development of service ecosystems (Böhmann et al., 2014). An important role is present here for IS research, offering a trans-disciplinary perspective on how IT-based innovation can be integrated through business structures, and contributing to the existing knowledge base through evidence-based or design-based research. Accordingly, SSE calls for IS research to focus on the development of design theories, methods and tools directed at the engineering of service architectures, service systems

interactions and resource mobilization, clarifying how the development of such ecosystems can be supported and fostering the (opportunities for) collaborations between customers and service providers.

2.2 Service-dominant business model design

The concept of *business model* has received increased attention in IS research for its descriptive power and its pivotal role in establishing alignment between concepts such as strategy, operational processes and IT (Veit et al., 2014). A business model describes the logic of how value is created and captured (Osterwalder & Pigneur, 2010) and makes explicit how this logic is supported through the deployment of resources and IT (Al-Debei & Avison, 2010). Accordingly, in IS research, it is typically used to contextualize novel IT innovations, understanding their importance and impact and exploring the appropriate business structure to accommodate their implementation. Given the increased prevalence of a service-orientation for organizations, several scholars have focused on the conceptualization of *service-dominant* business models as opposed to a traditional orientation of business models, which call for an ecosystem or networked perspective of business models, taking service provisioning at its core (Adner, 2017). This has led to work focusing on the conceptual integration between SDL and the business model concept (Clauß et al., 2014; Kindström, 2010). Moreover, several researchers have focused on supporting the design of service-dominant business models through techniques and tooling.

For instance, Ojasalo & Ojasalo (2015) propose the Service Logic Business Model Canvas (SLBMC), which takes the traditional Business Model Canvas (BMC) (Osterwalder, 2004; Osterwalder & Pigneur, 2010) at its core and extends this through SDL theory. Accordingly, the SLBMC is explicitly value-oriented, for which the traditional business model elements represented for the BMC have been extended by means of an explicit consideration of what value each element may create for the customer. However, similar to the BMC, the SLBMC considers business model design from the perspective of a single organisation, which in light of the conceptualization of service ecosystems is ill-suited, concerning configurations involving business networks aimed at value co-creation.

Taking into account the need for a networked-orientation of business models, Zolnowski et al. (2014) propose the Service Business Model Canvas (SBMC), which unlike the SLBMC, consists of a 'stack' of interconnected business models, for which each actor in the business network is described by an individual service-based BMC. Accordingly, service ecosystems can be defined through the design of several interconnected BMCs that represent the actors that partake in the service ecosystem and how these actors co-create value.

Similarly, Lüftenegger et al. (2013), Grefen et al. (2013) and Turetken et al. (2017; 2019) present the Service-Dominant Business Model Radar (SDBM/R). The SDBM/R constitutes a circular template that takes the value-in-use created for the customer at its core, which is encapsulated by the set of network actors and their resources that jointly co-create this central value-in-use (see Figure 1). Accordingly, the SDBM/R enables users to explicitly model the *service ecosystem* for any given service solution or value-in-use (Grefen & Turetken, 2018). To clarify how this value-in-use is established, one can see that each actor slice is divided into three sections, allowing the representation of the actor value proposition (explaining how each actor contributes to the central-value-in-use), its co-production activity to produce this value proposition (representing the resources deployed and or exchanged), and the actor specific costs and benefits that are generated (describing how value is captured through participation). Therefore, through the inner and middle ring, the SDBM/R facilitates users to model characteristics of service-based business initiatives related to *value co-creation*. In addition, the costs and benefits ring facilitates the user to make explicit what business case may underlie such service-based business initiatives. Given the need to conceptualize networked business collaborations for service ecosystems, we use the SDBM/R for the remainder of this work to represent the design of service-dominant business models.

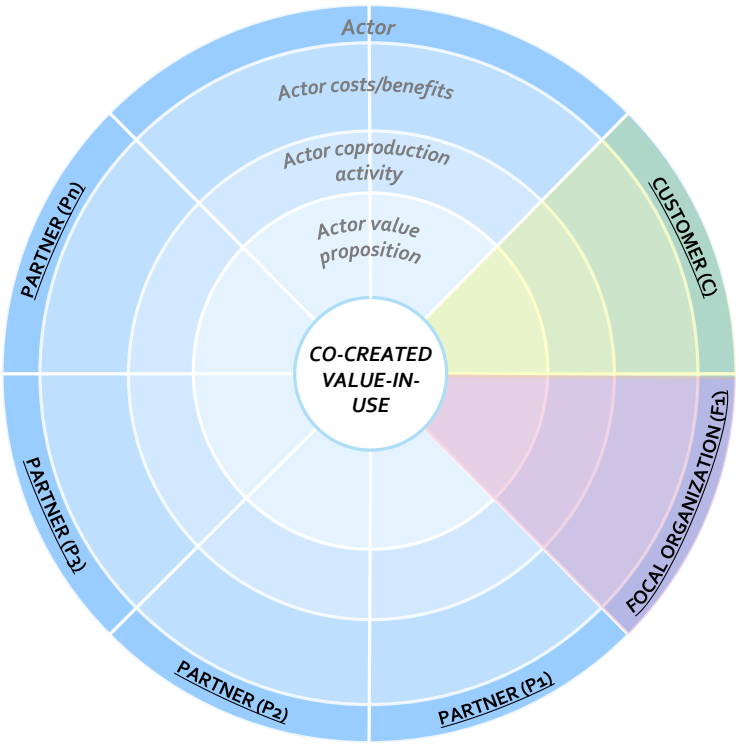

Figure 1: Template for the Service-Dominant Business Model Radar (Turetken et al., 2019)

2.3 Business model evaluation

Business model evaluation is argued to positively influence the outcomes of business model innovation (Schrauder et al., 2018), and helps to reduce uncertainty for decision making with respect to the structure of a business model or to support selection between alternatives (Brea-Solís, Casadesus-Masanell, & Grifell-Tatje, 2015; Schneckenberg, Velamuri, Comberg, & Spieth, 2017). Research on business model evaluation has focused on different quality attributes related to the performance of business models. For instance, ample research stresses the importance of the *viability* of business models (Ballon & Delaere, 2008; Gilsing et al., 2018; McGrath, 2010), related to how (financially) profitable or valuable a business model is. However, research has also focused on the *feasibility* (De Vos & Haaker, 2008), *robustness* (Haaker et al., 2017; Täuscher & Abdelkafi, 2018) and *structural validity* (Zott & Amit, 2010) of business models. Here, *feasibility* relates to the degree to which a business model design can be implemented and to what extent resources and capabilities are or will be available to deploy the business model (Adali, Turetken, Ozkan, Gilsing, & Grefen, 2020; De Vos & Haaker, 2008). *Robustness*, on the other hand, considers the uncertainty that may be present with regards to the business model and to what extent the technical and financial performance of the business model design may be affected by unexpected changes. Lastly, *structural validity* refers to the understanding of whether the logic behind the business model is valid and sound; this has significant implications for its predicted performance. Accordingly, structural validity can be seen as the basis for determining the feasibility, viability and robustness of a business model.

Business model evaluation can be conducted both *ex-post* (i.e., when the business model is fully or partially operational) as well as *ex-ante* (i.e., when the business model is a blueprint design and not yet implemented) (Mateu & Escribá-Esteve, 2019). For the former, research argues that practices such as trial-and-error learning and experimentation can be used to support the evaluation and to understand its performance in practice, which may serve to motivate adjustments to the business model (McGrath, 2010; Sosna, Trevinyo-Rodriguez, & Velamuri, 2010). For the latter, however, as the business model is not yet operational, business modelers are typically required to make decisions based on predictions. Such predictions can be based on quantified insights, but can also be the result from eliciting (more subjective) assessments from stakeholders (Frishammer, Floren, & Wincent, 2011). Given that the early

phases of business model development and innovation are characterized by significant uncertainty, qualitative approaches towards business model evaluation are advocated (Tesch & Brillinger, 2017).

Several techniques and tools have been proposed to support qualitative business model evaluation. For instance, Mateu & Escribá-Esteve (2019) propose a question-based tool grounded on the general business model evaluation questions proposed by Teece (2010). Each question is accompanied by a set of scoring options that elicit opinions from stakeholders with respect to elements or the performance of the business model. Using the tool, stakeholders can ultimately calculate a score that can be used as the basis for further decision making and comparison. However, for the evaluation of service-dominant business models, the tool offers limited support with respect to a holistic consideration of a network of organizations and does not cater well to the concepts, such as value co-creation and servicing.

Similarly, Diaz-Diaz et al. (2017) propose the non-profit business model canvas for the analysis and evaluation of ecosystems in the smart mobility domain. Whilst the use of the canvas helps in understanding the structural validity of the business model and is catered to a more service-oriented setting, it offers limited support in gathering insights for business model evaluation quality attributes, such as viability, feasibility and robustness. Moreover, the organization-centric nature of the canvas makes it difficult to understand how stakeholders in the network can individually perceive the business model design.

Lastly, Gilsing et al. (2020) and Wilbik et al. (2020) propose a technique to support the translation of strategic objectives into business model catered KPIs, which can be used to support service-dominant business model evaluation. Although the technique specifically focuses on service-dominant business models, addressing the challenges of capturing the strategic intent of each actor represented for the business network (i.e., service ecosystem), the technique does not address the valid design of the service-dominant business model and its associated characteristics, nor does it facilitate users to reflect on the expected performance of the business model design.

In short, although a number of techniques have been proposed towards the qualitative evaluation of business models, we observe that these techniques do not cater well to the characteristics of service ecosystems (i.e., clarifying value co-creation through networked service exchange) to accommodate their effective evaluation. Therefore, we have designed a new method to fill this research gap.

3 Research design

To guide our research endeavours, we have followed a *design science research* methodology (Peffers et al., 2007). Accordingly, we identify the following research steps (as depicted in Figure 2): *problem identification, definition of artifact objectives, design and development* and *demonstration and evaluation*. In the following sections, we detail these research steps.

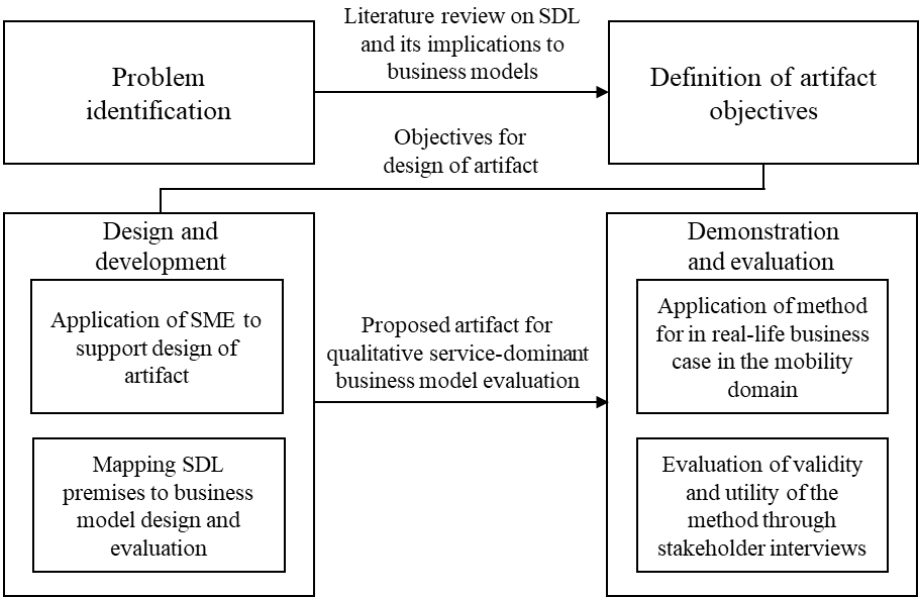

Figure 2: Research design (based on Peffers et al., 2007)

3.1 Problem identification

As discussed in the introduction, the increased prevalence of a service-orientation for contemporary organizations has significant effects for how organizations do business and sustain competitiveness. We observe that, in contrast to traditional, goods-oriented settings, organizations engage in service ecosystems to offer holistic service-based solutions and to better cater to customer needs. Accordingly, such service ecosystems constitute a network of actors that co-create value through service exchange and resource integration. Logically, in contrast to traditional, goods-dominant settings, such service ecosystems pose additional requirements with regards to how such systems should be configured and concretized, as these systems are highly networked in nature and dependant on the perceptions and motivations of the actors involved. Here, decision makers can significantly benefit from normative guidance and tooling to support the effective design of service ecosystems, particularly in early phases of the design and innovation process. Using the business model concept as a means to conceptualize service ecosystems, this places emphasis on supporting the evaluation of service-dominant business models, taking into account key service-dominant concepts such as value co-creation and service exchange. However, current literature does not offer support to effectively address these challenges. Without such guidance, the long-term viability of service ecosystems may be significantly threatened, impacting the actors involved. Accordingly, in response to this research gap, we therefore focus on the development of a method towards the qualitative evaluation of service-dominant business model designs, contributing to the further conceptualization of service ecosystems and providing a means to practitioners to effectively evaluate novel service ecosystem designs.

3.2 Definition of artifact objectives

In light of the identified research problem, we define the following objectives for the development of our artifact:

Obj1: The proposed artifact should be based on the premises of SDL.

Rationale: SSE is a derivative of the SDL paradigm (Böhmann et al., 2014), explaining and structuring how service-oriented organizations co-create value through collaboration. Accordingly, SDL captures the requirements or logic central to any novel service ecosystems, and as such should serve as the basis for the development of our method. Accordingly, we aim to ensure that our method addresses the key concerns of any service ecosystem in terms of value co-creation and service exchange and is able to translate this into clear and adequate evaluation insights.

Obj2: The proposed artifact should enable decision makers to evaluate service-dominant business model designs with respect to their structural validity, viability, feasibility and robustness.

Rationale: As the ex-ante business model performance is often expressed by means of the diverse set of quality attributes, such as *structural validity*, *viability*, *feasibility* and *robustness* (De Vos & Haaker, 2008; Haaker et al., 2017; Täuscher & Abdelkafi, 2018), our method should be able to address this set of quality attributes to facilitate a comprehensive evaluation of business models representing service ecosystems. As a result, this should facilitate decision makers to shed light on different concerns with regards to its expected performance and its relative design or configuration, enabling more informed decision making with respect to the design and configuration of service ecosystems. In turn, this should improve the long-term survivability and success of such service ecosystems (Schulz, Böhm, Gewald, Celik, & Krcmar, 2020).

Obj3: The proposed artifact should produce qualitative insights on the expected performance of service-dominant business models.

Rationale: We focus our method specifically on design phases of business conceptualization and innovation to support decision making. As explained, particularly the early phases of design are often characterized by significant uncertainty as the business model design is likely to be high level in nature and subject to significant change, making it difficult to (quantitatively) predict its outcome (McGrath, 2010). In such cases, qualitatively-oriented approaches are preferred to offer flexibility to deal with uncertainty (Frishammer et al., 2011; Tesch & Brillinger, 2017). Accordingly, by means of this objective, we aim to ensure that our method produces qualitative insights such that it is adequate for use in business model design, i.e., early in the business model innovation process and later in its lifecycle when the business model is ought to be re-designed.

3.3 Design and development

To provide structure to the design process for our method, we have followed a *situational method engineering approach* (*SME*), which offers a structured yet flexible methodology for the development of new artifacts or methods, which can be catered and moulded to the requirements of the industry or research project (Henderson-Sellers, Ralyté, Ågerfalk, & Rossi, 2014; Ralyté et al., 2003). Accordingly, we can better make explicit how we have developed our method.

For SME, three alternative strategies can be selected to guide the development of the method, namely a *paradigm-based strategy* (develop a suitable method based on theory or paradigms), an *extension-based strategy* (develop a suitable method by extending an already existing method) or an *assembly-based strategy* (develop a suitable method through integrating several method or method components) (Ralyté et al., 2003). As the development of our method depends on the integration of theory with respect to SDL, business model design and business model evaluation, we follow a *paradigm-based strategy* to accommodate this, as illustrated in Figure 3. In doing so, we identify the following design steps: *1. Construction of a product model* and *2. Construction of a process model*. Here, a *product model* refers to the concepts, constructs and language embedded for the method (the 'core' of the method), whereas the *process model* refers to how the method is used (i.e., how the *product model* is applied).

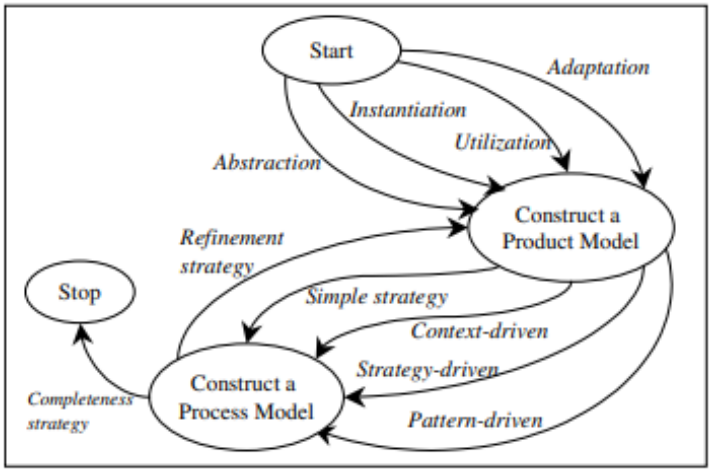

Figure 3: Paradigm-based strategy for SME (Ralyté et al., 2003)

As our aim is to develop a method to support the qualitative evaluation of service-dominant business models (in line with objective 3), we select a question-based technique as a basis for the development of our method, which is often used for the qualitative evaluation of business models (Dellermann, Lipusch, Ebel, & Leimeister, 2018; Osterwalder & Pigneur, 2010). Accordingly, our product model consists of a set guiding questions that enable the evaluation of service-dominant business model designs. We derive these guiding questions as follows. First, we study the general theory on business model design and evaluation, which provides the context in which our questions are positioned using the quality attributes mentioned for business model evaluation. In doing so, we satisfy objective 2. Next, in line with objective 1, we study the theory on SDL and examine the implications that it brings forth with respect to business model design and evaluation. Consequently, we translate these implications into a set of guiding questions that can be used by business modelers to support the qualitative evaluation of service-dominant business model designs. The stepwise process for constructing the product model is illustrated in Figure 4.

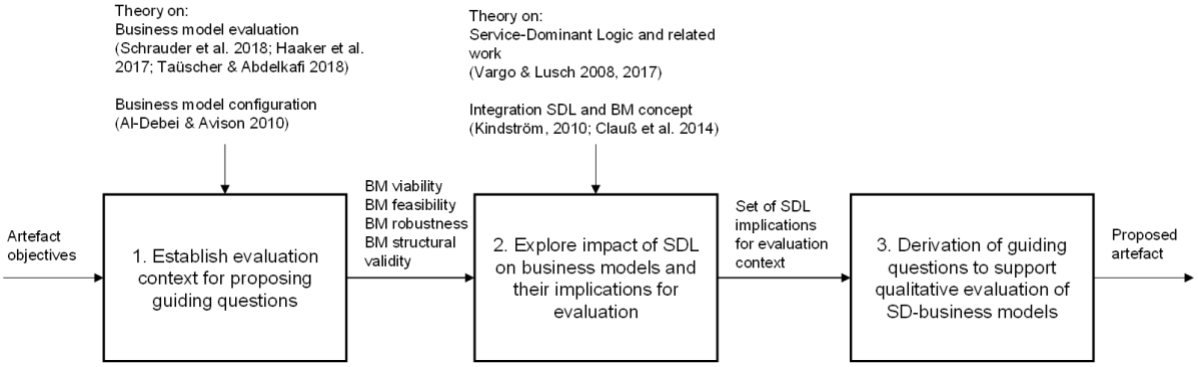

Figure 4: Steps followed to construct the product model for our method

To construct our process model, e.g., describing how the method should be used, we followed a *simple strategy*, meaning that we do not require to cater our process model to a specific strategy or context, but rather delineate the general steps taken for any given context (Ralyté et al., 2003). Based on the logical relationships between the quality attributes structural validity, viability, feasibility and robustness, we determine the sequence by which the set of questions is applied. The use of our method is further elaborated in Section 4.

3.4 Demonstration and evaluation

We demonstrate our method by means of application in a real-life business case. The business case has emerged from the mobility domain, which focused on conceptualizing and marketing a platform-based

solution to improve travel efficiency across Europe. Given the service-driven and collaborative nature of the solution, the project aimed to do so through service-dominant business modelling efforts. By means of a set of business model workshops, a service-dominant business model draft was designed this each case, represented by means of the SDBM/R. As a next step, this business model had to be evaluated to further concretize the model and motivate its subsequent operationalization and implementation. To this end our method was applied. We have selected this case as the mobility domain is strongly representative of the problem context (Yin, 2017), in the sense that novel mobility initiatives increasingly are characterized by a service-dominant mindset (Böhmann et al., 2014; Grefen et al., 2015; Schulz, Böhm, Gewald, Celik, & Krcmar, 2020). In addition, the case possessed the characteristics required for application of the method, as the service-dominant business model was defined previously (and awaiting evaluation), whereas stakeholders accordingly already had experience on service-dominant business modelling (Yin, 2017).

In line with design science research, the development of novel design artifacts should be accompanied by and evaluation of the *validity* (i.e., the degree to which the artifact works as intended) and *utility* (i.e., the value generated for the users through use of the artifact (Gregor & Hevner, 2013; Lukyanenko, Evermann, & Parsons, 2014; Peffers, Rothenberger, Tuunanen, & Vaezi, 2012). Through application of the method in the real-life mobility business case and understanding how it contributes to decision making on service-dominant business models, we have evaluated the *validity* of the artifact.

To further understand the *utility* of the method, we elicited feedback from the participants of the evaluation workshop in which our method was applied. To elicit the participants' view on the utility, we focused on the constructs of *perceived usefulness*, *perceived ease of use* and the *perceived intention to use* in line with the core constructs of the *Technology Acceptance Model (TAM)* (Davis, 1989; Venkatesh & Davis, 2000). *TAM* theory is commonly used to in the information systems and related fields to understand and predict the acceptance of new technologies or design artifacts (Dikici, Turetken, & Demirors, 2018; Moody, 2003; Venkatesh, Morris, Davis, & Davis, 2003). *Perceived usefulness* refers to the user's perception with regards to how the artifact benefits the performance of the user in a given context. *Perceived ease of use* entails the perception of the user with respect to the degree to which use of the artifact would not require physical or mental effort (Davis, 1989). Lastly, *intention to use* is a determinant of the constructs *perceived ease of use* and *perceived intention to use* and explains user acceptance of the artifact. We used these three constructs as the basis for driving the discussions within the semi-structured interviews and to elicit feedback with regards to the generated utility of our method. The structure and set-up of the demonstration and evaluation of the method is further discussed in Section 5.

4 Method description

In this section, we discuss the method that we propose for the qualitative evaluation of a service-dominant business model design (SD-BMD). In the following, we present a general overview of the method, and consequently discuss how the questions contribute to the aforementioned quality attributes used for business model evaluation, explaining the underpinning to our set of questions that constitute our method.

4.1 Method overview

Through the design process described in Chapter 3, we have derived 21 guiding questions towards the qualitative evaluation of service-dominant business models. The questions are grouped based on the quality attribute they address (i.e., *structural validity*, *feasibility*, *viability* and *robustness*). Through the use of the questions, stakeholders can, in a structured way, obtain insights with regards to the outcomes of their business model design, and assess whether design decisions made are valid or whether the business model design should be altered depending on the outcomes. Given the collaborative nature of the service-dominant business models, questions should collaboratively be discussed by the set of stakeholders represented in the service ecosystem and should collectively determine the response to a

question. To deal with uncertainty with respect to the business model design, particularly in the early phases of business model innovation, such responses are qualitatively oriented.

With regards to the use of the method (the designed process model), we pose that the evaluation of the *feasibility, viability and robustness* of a service-dominant business model design should be preceded by the evaluation of its *structural validity*, such that always a logically valid model is considered before assessing the technical or financial performance of the design. Accordingly, the following procedural description, as illustrated in Figure 5 should be followed for use of the method.

As can be seen in Figure 5, the decision nodes are included after evaluation of the structural validity and evaluation of the feasibility, viability and robustness of the service-dominant business model design. A model whose design is deemed structurally invalid implies that the logic that it aims to capture is not appropriate or correct and accordingly should be altered. Once valid, evaluation of the feasibility, viability and robustness commences. Here, stakeholders generate a (shared) understanding of the expected feasibility, viability and robustness of the business model design, and consequently determine whether the business model design can be deemed *acceptable* (which should be considered in light of any strategic intent stakeholders have for business model participation). Note that even though, for example, the feasibility of the business model can be considered low, it can still be deemed acceptable depending on the strategic considerations. If acceptable, the business model design is qualitatively evaluated and can further be concretized and quantified. If (any of the) stakeholders deem the model inacceptable, this calls for a reconsideration of the business model design or requires stakeholders to reflect on whether the strategic intentions per stakeholder set for the business model should be changed.

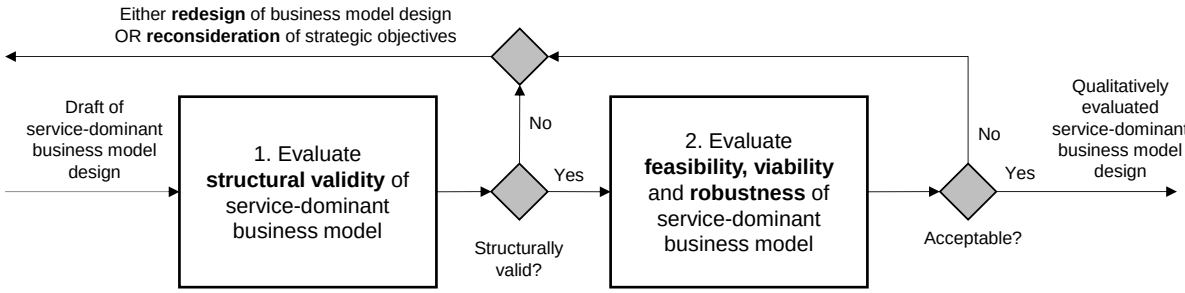

Figure 5: Process model describing the use of the proposed method

In line with the aforementioned procedure, we provide different degrees of freedom on how questions can be answered, based on the quality attribute they address. For structural validity, the questions focus on validating whether the service-dominant business model design adheres to the premises of SDL, and as such whether the logic represented for the business model is valid. Accordingly, questions related to the structural validity are stated in a *closed* form (in binary form, 'yes' or 'no'). Therefore, any negative answer for a structural validity question indicates a lack of adherence to the SDL principles or a logical invalidity in the design that has to be considered in the adjustment of the design. Note that, due to the interrelated nature of business model components, adjustments required in a certain business model design element (as a result of an application of the evaluation questions) can impact other design elements. This reflects the iterative nature of the evaluation task.

On the other hand, for the quality attributes of feasibility, viability and robustness, we provide increased degrees of freedom for the answers to related questions in the form of Likert items. The aggregated set of scores or responses to questions related to these quality attributes may serve as the basis for discussion, comparison or the selection between business model design alternatives, depending on the strategic objectives or goals set per actor in the service ecosystem. Again, a low score for either feasibility, viability or robustness does not always imply that the model is inherently bad or should not be pursued – a lack of current feasibility but a strong viability and robustness may drive decision makers

to explore or experiment how feasibility can be improved (demonstrating the iterative nature of business model design and evaluation).

In the next sections, we elaborate on the quality attributes for business model evaluation, and explain the subset of questions we have derived per quality attribute including the justification for their need and relevancy.

4.2 Structural validity

For structural validity, we verify whether the SD-BMD adheres to the implications of adopting SDL and whether the business logic underlying the business model is valid. As it addresses the general structure of business models, we sub-divide the questions relevant to this quality attribute with respect to the business model componentization proposed by Al-Debei & Avison (2010). They consider a business model to constitute of the following elements: *value network, value finance*, *value architecture* and *value proposition*. We have selected this componentization as it explicitly considers business models to be established through value networks, which fits the general notion of SDL. However, to account for a more neutral perspective on what value constitutes (which can be of a financial nature, but also non-financial), we change the wording from *value finance* to *value capture*. The full list of questions to evaluate the structural validity of service-dominant business models is presented in Table 2.

Table 2: Set of guiding questions to assess the structural validity of service-dominant business models

		Evaluation questions	**Label**	**Response**	
Structural validity	Value network	Does the SD-BMD consist of at least three actors?	Q1	No	Yes
		Is the customer an explicit actor in the SD-BMD?	Q2	No	Yes
		Does each actor interact with at least one actor in the SD-BMD?	Q3	No	Yes
		Do all actors in the SD-BMD interact on the same level of hierarchy?	Q4	No	Yes
	Value proposition	Can the expected value-in-use follow from the set of actor value propositions?	Q5	No	Yes
		Does the expected value-in-use match or address the needs of the customer?	Q6	No	Yes
	Value architecture	Does each actor value proposition realistically result from its deployed operant and operand resources?	Q7	No	Yes
		Does the service offering of the SD-BMD enable or support the value creation process of the customer?	Q8	No	Yes
	Value capture	Does each actor in the SD-BMD have at least one cost and one benefit listed?	Q9	No	Yes
		Are all costs and benefits as a result of exchange reciprocally listed in the SD-BMD?	Q10	No	Yes

Value network

SDL emphasizes the importance of *value co-creation*, including the beneficiary, as opposed to the traditional GDL perspective that argues from distinct supplier-customer relationships (Axiom 2 and Axiom 5, see Table 1). Accordingly, organisations operate in service ecosystems, in which services are exchanged for mutual betterment and value is co-created (Böhmann et al., 2014; Grönroos & Ravald, 2011; Jaakkola & Hakanen, 2013; Vargo & Lusch, 2017). As a consequence, the service-dominant business model, which represents how value is created, appropriated and captured, is always networked in nature, featuring the customer as an active co-creator (Clauß et al., 2014; Nenonen & Storbacka, 2010). Accordingly, the service-business model design should feature *at least* three actors (reflected in Q1 in Table 2). Moreover, SDL explicitly considers the beneficiary as a key stakeholder for value co-

creation (Axiom 2). As such, the customer should be explicitly considered as an actor in the business model design, which is verified by means of Q2.

For solution-oriented networks or service ecosystems, value co-creation is based on the exchange and integration of resources and services between actors in the service ecosystem (Hakanen & Jaakkola, 2012). Accordingly, actors are considered resource integrators in service-dominant business settings (Axiom 3). As a consequence, no actor can operate in isolation in the service-dominant business model design (Q3), as this would not enable value co-creation. Lastly, given the collaborative setting in which value is co-created, and given that the service is the basis for exchange, actors in service-dominant business models should act on the same level of hierarchy to facilitate interaction (Q4) (Clauß et al., 2014; Maglio & Spohrer, 2013). In contrast to traditional value chains, in which the customers of suppliers can be the suppliers of other customers (hierarchical relationships), the collaborative networked setting requires heterarchical relationships between actors in the service-dominant business model design.

Value proposition

As a service-dominant business model describes how value is co-created through the collaborative efforts of network partners, each actor in its design generates part of the value that is ultimately offered to the customer. Considering Axiom 2 and 4, only the beneficiary can appropriate value (Grönroos, 2011; Vargo & Lusch, 2008). Therefore, actors can only generate or offer *value propositions* (Lusch, Vargo, & O'Brien, 2007). In turn, the set of value propositions should determine the value (or *value-in-use,* if used in a certain context) that is created for the customer (Böhmann et al., 2014; Hakanen & Jaakkola, 2012). As such, one should verify whether the value-in-use central to a SD-BMD can be construed from the set of value propositions offered by the actors in the business network or service ecosystem (Q5). Logically, the value-in-use that is proposed should always be considered in light of the beneficiary, and should therefore realistically address the needs of the beneficiary (the customer in a business model design) (Q6).

Value architecture

SDL considers service as the fundamental basis for exchange (Axiom 1), for which the structure of the service ecosystem and the exchange of services determines what value ultimately is co-created (Böhmann et al., 2014; Hakanen & Jaakkola, 2012; Vargo et al., 2008). Furthermore, SDL states that each service is composed of actor-specific *operand* (tangible assets, tools) and *operant* (intangible capabilities, knowledge and skills) resources deployed (Grönroos & Ravald, 2011; Vargo & Lusch, 2008). Given the value propositions proposed per actor in the business model design, one should thus verify whether the services exchanged by actors in the service ecosystem can result from the activities that are conducted or the resources (e.g., operand and operant) that are deployed (Q7) (Schulz, Gewald, et al., 2020). Moreover, as the customer ultimately determines or appropriates the value of a service (Axiom 4) (Grönroos, 2011), the offered service should enable or support the customer in its value creation process (Q8).

Value capture

As opposed to traditional customer-supplier relationships, the exchange of service is considered inherently mutually beneficial (Lusch & Nambisan, 2015; Maglio & Spohrer, 2013): given the interaction-based nature of services and the notion that value is determined by the beneficiary, actors that partake in service exchange mutually agree on the value that is proposed (Vargo & Akaka, 2009). Offering service requires the deployment of resources to propose value, which should be acceptable for the recipient. In turn, the servicing actor is able to capture (reciprocal) value. Expressing value in terms of costs and benefits accrued, this means that actors in SD-BMD, which do not act in isolation, should at least have one cost and one benefit as the result of service exchange (Q9). Moreover, as costs and

benefits transferred for service exchange are reciprocal, one should verify that such costs and benefits are reciprocally listed for the SD-BMD (Q10).

4.3 Feasibility

The feasibility of business models can be explained as the access to resources, capabilities and interfaces that are needed to be able to operationalise or implement the business model design, as well as barriers or risks that may exist with respect to this task (Haaker et al., 2017). Such resources may refer to technical capabilities or human competencies, but may also concern legal or social barriers that inhibit the application of these resources (Schulz, Gewald, et al., 2020). As service-dominant business models are networked and feature many actor-to-actor exchanges and the integration of external and internal resources to propose value to the customer (Axiom 2, Axiom 3, and Axiom 5), one should verify the extent to which the modelled service ecosystem represented by the SD-BMD possesses or may possess the properties to enable this. The list of guiding questions to assess SD-BMD feasibility is presented in Table 3**.**

Table 3: Set of guiding questions to assess the feasibility of SD-BMD

	Evaluation questions	**Label**	**Response**				
Service-dominant business model feasibility	To what extent does each actor in the SD-BMD have access to its listed operant and operand resources?	Q11	Very low	Low	Moderate	High	Very High
	To what extent are communication and resource interfaces present between actors in the SD-BMD?	Q12	Very low	Low	Moderate	High	Very High
	To what extent are legal and technological barriers present towards implementation of the SD-BMD?	Q13	Very low	Low	Moderate	High	Very High
	To what extent does trust or mutual understanding exist between actors in the SD-BMD?	Q14	Very low	Low	Moderate	High	Very High

Similar for the evaluation of traditional business models, one should assess whether each actor represented for the business model design has access to the resources required to support its modelled activities or is able to obtain access to such resources (dependent on how concretely each actor is defined) (Q11). In contrast to traditional business models, which typically reason from the perspective of the focal organization, in service-dominant business models this logically refers to all actors represented for the service ecosystem. In addition to this, given the collaborative nature of such business models, it is important to verify how actors within the service ecosystem are able to interact and exchange resources. More specifically, exchanging services between actors to co-create value requires the establishment of resource and information interfaces to support this exchange (Hakanen & Jaakkola, 2012; Maglio & Spohrer, 2013; Nenonen & Storbacka, 2010). Therefore, with respect to the feasibility of service-dominant business models, one should verify the extent to which these interfaces are present or can be established (Q12).

Furthermore, one should assess what legal and technological barriers are present towards the operationalization of the business model that can potentially inhibit its feasibility (Haaker et al., 2017) (Q13). Lastly, given the importance of trust in the establishment of business or solution-driven networks (Clauß et al., 2014; Jaakkola & Hakanen, 2013), it is important to assess the degree of trust or mutual understanding that exists between actors. A lack of trust may significantly impact how actors collaborate in networks, for instance, by influencing the information or resources they are willing to share (Vargo et al., 2008) and in turn affecting how actors co-create value. To evaluate this, we pose Q14.

4.4 Viability

Business model viability is largely considered as the business performance for actors involved or the perceived balance of benefits and costs that are captured by each actor through participation (Ballon & Delaere, 2008; Gilsing et al., 2018; Haaker et al., 2017). It is often considered as a key driver for business model participation (Morris, Schindehutte, & Allen, 2005). Given that all actors in a service-dominant business model contribute part of the value that is proposed the customer (A2, A5), the viability of service-dominant business models depends on whether *each* actor in the design perceives to capture more benefits than costs (Turetken et al., 2019). Logically, this perception is dependent on whether the costs and benefits listed can reliably be measured or quantified in terms of financial outcomes (Allee, 2008; Peppard, Ward, & Daniel, 2007) and whether the listed costs and benefits are acceptable in terms of the strategic goals or motivation the actor has for participating in the SD-BMD (Gilsing et al., 2018). Accordingly, to assess the viability of the SD-BMD, one should verify the extent to which the respective actor's costs and benefits can be measured or quantified (Q15), the extent to which costs and benefits align with the strategic goals set per actor for participation in the business model design (Q16) and the extent to which the costs and benefits accordingly can be balanced per actor (i.e., that at the very least a neutral balance is obtained) (Q17).

The list of questions to assess viability is presented in Table 4.

Table 4: Set of guiding questions to assess the viability of service-dominant business models

	Evaluation questions	**Label**	**Response**				
Service-dominant business model viability	To what extent can the costs and benefits per actor in the SD-BMD be measured or quantified?	Q15	Very low	Low	Moderate	High	Very High
	To what extent do the costs and benefits per actor in the SD-BMD satisfy strategic goals of each actor?	Q16	Very low	Low	Moderate	High	Very High
	To what extent can the costs and benefits realistically be balanced per actor?	Q17	Very low	Low	Moderate	High	Very High

4.5 Robustness

Lastly, business model robustness captures the uncertainty with respect to either business performance (viability) or technical performance (feasibility) (Haaker et al., 2017; Täuscher & Abdelkafi, 2018). As both the feasibility and viability of the SD-BMD depend on how the business model design is structured, we structure the questions to assess business model robustness along the componentization of Al-Debei & Avison (2010) to understand how changes for the business model design influence viability and feasibility (and thus indicate the robustness of the business model). The questions are presented in Table 5.

Given that the value that is ultimately proposed to the customer is dependent on the configuration of the network, representing the actors that each contribute a part of this value proposition (A2), as well as the fact that in order to co-create value actors exchange and integrate services (A3), the robustness of the service ecosystem with respect to the viability and feasibility of the business model design should be assessed (Jaakkola & Hakanen, 2013). Different compositions of the ecosystem may yield different value propositions which accordingly may influence the viability and feasibility of the business model. To verify the robustness of the business or *value network*, we therefore assess the extent to which actors in the service ecosystem can be replaced or substituted by different actors, or the extent to which actors can be removed from the business model design in light of the viability and feasibility of the SD-BMD (Q18).

Table 5: Set of guiding questions to assess the robustness of service-dominant business models

	Evaluation questions	Label	Response				
Service-dominant business model robustness	To what extent can actors in the SD-BMD be substituted or replaced?	Q18	Very low	Low	Moderate	High	Very High
	To what extent are costs and benefits listed per actor in the SD-BMD subject to uncertainty?	Q19	Very low	Low	Moderate	High	Very High
	To what extent can the expected value-in-use of the SD-BMD be catered and offered to different customer segments?	Q20	Very low	Low	Moderate	High	Very High
	To what extent are operant and operand resources deployed per actor subject to technological, market and legal developments?	Q21	Very low	Low	Moderate	High	Very High

With respect to *value capture*, we assess the uncertainty that may be present for the costs and benefits listed per actor, considering how these costs and benefits may develop throughout the course of the business model (Q19). Changes for these costs and benefits may be the result of different pricing mechanisms or strategies, expected shifts in demands or usage of the service or uncertainty with respect to future investments.

To assess the robustness of *value proposition*, we evaluate to what extent the central value proposition of the SD-BMD can be catered to or altered to accommodate different or novel customer segments (Q20). Accordingly, decision makers can determine the flexibility by which the value proposition can be changed to accommodate shifting customer needs or to expand on the current reach or scale of the business model design and reflect on the impact of the current value proposition.

Finally, for *value architecture*, related to the configuration of resources and interfaces that are deployed to support the business model design, we leverage Q21 to assess the extent to which expected technological developments may impact the current resources deployed or may impact what service solution can be offered to the customer. Similarly, we assess the extent to which market or legal developments, for instance to increase the scale by which the service is offered (which is relevant particularly in cases of platform business models) (Täuscher & Laudien, 2018), can be addressed.

The joint application of the set of questions, adhering to the procedural description presented in Figure 5, enables business modelers and decision makers to evaluate all key concerns of a service-dominant business model performance. In case the design does not prove to be structurally valid, business modelers should reconsider design decisions and alter the design to accommodate this. Depending on how stakeholders consequently perceive the performance of the business model, this may either result in a need for the redesign of the current business model or may serve as the starting point for its further concretization.

5 Method evaluation

As briefly mentioned in 3.4, for the evaluation of the method, we focussed on assessing its *validity* and *utility* (Gregor & Hevner, 2013). To do so, we have applied our method in a real-life business case drawn from the mobility domain to support the evaluation of service-dominant business model designs, and to assess its validity and utility. In this section, we introduce a business case in which the method was applied, and illustrate how the use of our method has contributed to the evaluation of its preliminary service-dominant business model blueprint, demonstrating the *validity* of the artifact. To evaluate its

utility, we refer to the results of the semi-structured interviews that we held with stakeholders that participated in this evaluation workshop.

5.1 Evaluating the validity of the proposed artifact

We applied our artifact in a real-life business case originating from the mobility domain to understand if the application of the method supports decision makers in evaluating a service-dominant business model design blueprint. In the following, we discuss the business case in detail and elaborate on how the method has been applied. In addition, we discuss what guiding questions triggered a need for business model redesign or a reconsideration of design decisions.

Application of the method for "Enhanced Mobility Service Provisioning"

Rapid technology change is enabling modern day travellers and commuters to travel at increasingly lower costs and through an ever expanding set of modes of transportation (Banister, 2011). However, as the modes of transportation expand and the set of transport operators associated with these modes of transport increases, it becomes increasingly difficult for travellers to determine the most suitable or appropriate travel itinerary depending on their needs and requirements, and to manage the interfaces that exist between different transport operators (as each transport operator typically deploys its own service interface and has its own ticketing system). This may especially be problematic for international travel, for which language and policy barriers may generate increased complexity for travellers to adequately manage their trip.

In light of these challenges, a European Innovation and Technology (EIT) project consortium focused on the development of service-dominant collaborative solutions to offer *seamless and optimised travel to customers*, integrating the resources of stakeholders such as cities, traffic authorities, mobility service providers (e.g., transport operators, but also transport providers) and insurance and transaction providers. To this end, a set of business model workshops were organized to ideate business models that would enable the value proposition listed above.

The resulting service solution entailed a platform on which mobility service providers can register and offer their transport service (also known as the Mobility as a Service - MaaS platform) (Coconea, Mizaras, Turetken, Dovinola, & Grefen, 2019; Mulley, 2017). In addition, services, such as insurance and complementary services, were also included in the platform. Through the use of the platform, end-users indicate their travel itinerary including travel preferences, and consequently select (or are recommended) the services of mobility service providers, and if desired services of insurance companies, that would satisfy these inputs. Once the set of transport services is agreed upon, the platform handles the payment and management of the tickets, and offers this as a single ticket to the end-customer.

The business model was iteratively designed through a set of business model workshops. The scope was initially set to the Netherlands, i.e., involving only domestic travel. The resulting business model design is illustrated in Figure 6 (left). The customer of the model is the (set of) mobility service provider(s), which makes its transport service available on the platform and to which enhanced mobility service provisioning is offered as a value proposition. The focal organisation for the model is the platform operator, responsible for the integration of services. The remainder of the network is composed of municipalities (responsible for setting policies to support the business model), the financial transaction provider (to smoothen and secure transactions between service providers), a technology provider (to maintain and scale the platform), traffic authorities (to present traffic data used to enhance transport services) and an insurance provider (to offer additional insurance with respect to travel itineraries).

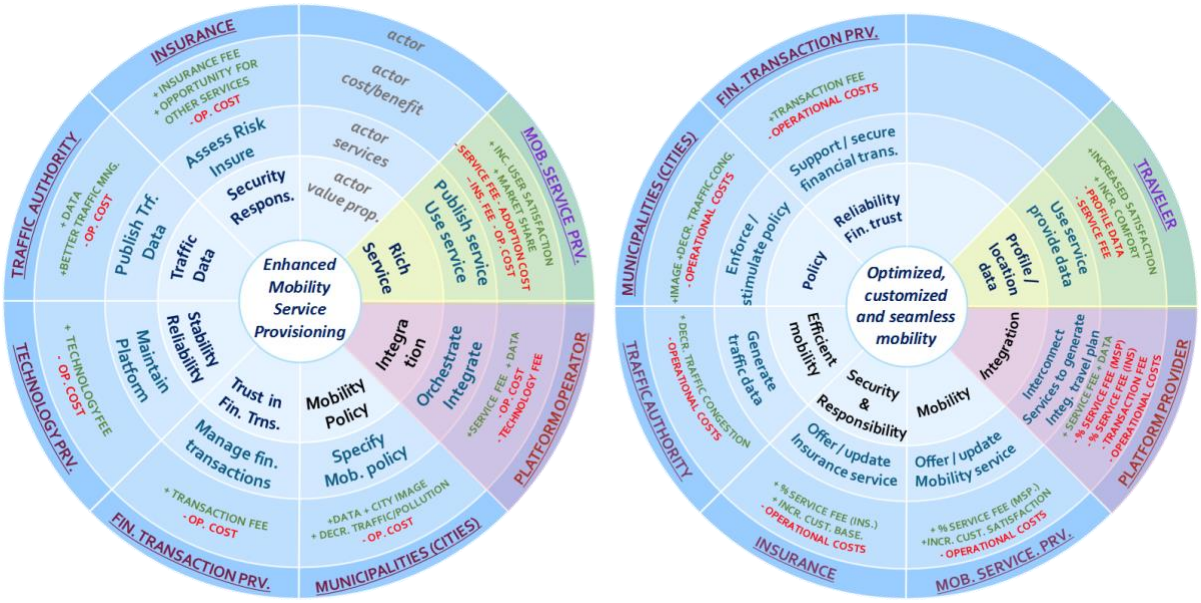

Figure 6: Changes in the business model design for "enhanced mobility service provisioning" as a result of method application

To support the qualitative evaluation of the service-dominant business model design, and to assess design decisions, our method was applied. To this end, six stakeholders, related to and representative of the roles of the insurance provider, platform operator, municipality and traffic authority, were present. Each stakeholder had at least two years of working experience for their respective organization. In line with the process model for our method, we first examined the structural validity of the business model design. Application of the corresponding guiding questions sparked a need for business model redesign, predominantly related to the value proposition (Q5 & Q6) and the value network (Q2 & Q4).

Based on questions Q2 and Q6, stakeholders indicated that the current customer segment selected was inadequate for the goal the consortium was aiming to achieve. For the initial model, the mobility service providers were selected as customers to the service, as the platform initially was considered from a B2B business perspective, as the success of the platform significantly depended on whether a critical mass in terms of mobility service providers participating for the platform would be achieved. However, the value proposition that the service solution was expected to generate (i.e., seamless and optimised travel to customers) did not align well with respect to this selected customer segment. Although generating the critical mass is important, the consortium determined that selecting the traveller as the customer for the business model design would enable the consortium to more explicitly target the desired value proposition. Accordingly, for the revised design (Figure 6, right), the traveller was selected as the customer to which the service of seamless, optimised and customised travel is offered.

With respect to Q4, the *technology provider*, which was initially included in the business model design, was deemed to operate through a bilateral, hierarchical relationship with the platform provider, focusing on the deployment and maintenance of the platform (thus proposing value in terms of scalability and reliability). However, the consortium deemed that this value proposition of the technology provider was embedded in the value proposition of the platform provider (integration of services is based on a stable and reliable platform environment). Accordingly, the technology provider was considered as an outsourced party to the platform provider and removed from the service-dominant business model design. Finally, based on Q5, minor revisions with respect to value propositions presented in the business model design were made – for instance, the traffic authority initially had a value proposition of "traffic data", but was later revised to *efficient* mobility (to better address the value-in-use listed). After the initial changes, the questions for structural validity were again applied, which did not result in a need to further change or revise the business model design.

Application of on the questions with respect to feasibility, viability and robustness resulted in a number of discussions on the revenue model currently considered, which was deemed to impact the *viability* and *robustness* of the model. Based on Q17 and Q19, stakeholders felt the current structure of the revenue model was inappropriate. Initially, the mobility service provider would pay a fee to the platform provider to publish their respective transport service to the platform and as such to connect to other transport services. However, the platform provider would not take care of interactions to other insurance or transaction providers – this would still be the responsibility of the mobility service provider. In this scenario, the platform provider therefore only serves as an interface to the traveller for mobility service providers, which would not be desirable. In contrast, it would be more effective to position the platform provider as a hub that takes care of all transactions and interactions amongst stakeholders in the service ecosystem. This would especially be relevant in case of trips that entail multi-modal transport, which require the services of several transaction, insurance and transport providers to be connected or integrated. Based on this, the revenue model, in particular the distribution of costs and benefits per stakeholder, was altered to reflect this novel revenue model. After a second application of the questions, the stakeholders deemed the viability, feasibility and robustness of the business model design to be *high*. However, in line with Q14 and Q16, the consortium did express some concerns with respect to whether mobility service providers would be inclined to openly share information on the platform and give up their personal customer touchpoints – this raised awareness for the consortium to explicitly articulate the benefits received through participation for mobility service providers.

The results of the application of our method to support service-dominant business model evaluation illustrate that the method enables decision makers to reconsider design decisions with respect to the SD-BMD and help decision makers in understanding the potential viability, feasibility and robustness of the model, providing evidence towards the validity of the method.

5.2 Evaluating the utility of the method

To understand the utility of our proposed method, we discussed the results of the application of our method with the practitioners involved for the presented business case (i.e., *enhanced mobility service provisioning*). In total, six participants were involved, representing the stakeholder roles of the *platform provider*, *municipality/ traffic manager* and *insurance provider* in the business model design (Figure 6). We complemented this set with two additional practitioners pertaining to a previously conducted case study orchestrated in the logistics domain, for which the method had also been applied. Therefore, in total, the input of eight practitioners was used to assess the utility of the method. We selected this set of practitioners as they had already been involved in the application of the method; hence, they were able to provide valuable insights regarding the utility generated through method application. Each practitioner had at least some knowledge on business modelling and had at least two years of experience at their current organization. The demographics of the practitioners are presented in Table 6.

Table 6: Demographics of practitioners participated in the evaluation

ID	Case	Organization	Tenure	Knowledge on business modeling
Practitioner 1	Mobility	Platform Provider	3 years	Knowledgeable
Practitioner 2	Mobility	Municipality/ Traffic Manager	5 years	Somewhat knowledgeable
Practitioner 3	Mobility	Platform Provider	3 years	Somewhat knowledgeable
Practitioner 4	Mobility	Platform Provider	8 years	Very Knowledgeable
Practitioner 5	Mobility	Insurance Provider	10 years	Very Knowledgeable
Practitioner 6	Mobility	Platform Provider	2 years	Somewhat Knowledgeable
Practitioner 7	Logistics	Service Provider	5 years	Knowledgeable
Practitioner 8	Logistics	Service Provider	2 years	Knowledgeable

The semi-structured interviews or discussions were held immediately after application of the method had been completed (i.e., after potential reconsideration or revision of the business model design). The discussions took roughly 30 minutes to complete and were moderated by two members of the research team. As mentioned in 3.4, we used the operationalized TAM constructs (*perceived usefulness, perceived ease-of-use, perceived intention-to-use*) to drive and guide our discussions. These discussions were not recorded (due to anonymity of the discussed contents). To mitigate this issue, two additional members of the research team were present to take notes throughout the discussions to capture the feedback received from the participants.

In addition to the semi-structured interviews, we asked participants to fill in a short questionnaire after completion of the workshop to obtain (further) feedback in written form. The set of evaluation questions used for the questionnaire is presented in Table 7. As recommended by Venkatesh and Davis (2000), we used 4 items to assess perceived usefulness, 4 statements to assess ease of use and 2 statements to assess intention to use, adapting each item to accommodate the characteristics of the proposed artifact (Moody, 2003). For each of these questions, we used a 5-point Likert scale to understand the level of agreement of the interviewee with respect to the statement at hand, for which 1 represents '*strongly disagree'* and 5 represents '*strongly agree*'. Some of the statements have been presented in negated form or 'reversed' to prevent participant to give monotonous responses to questions. Accordingly, the results for these questions are interpreted in reversed form. At the end of each questionnaire, sufficient room was given to each participant to provide additional feedback. We used *content analysis* to support and structure the analysis of the results (Krippendorff, 2018).

Table 7: Set of questions used to evaluate the utility of the proposed method

Evaluation construct	**NR.**	**Statement**
Perceived Usefulness	1	I think this method helps to support the evaluation of service-dominant business models
	2	The evaluation questions of the method would facilitate me to reflect on design choices with respect to the service-dominant business model
	3	I felt I missed questions to effectively evaluate a service-dominant business model*
	4	Overall, the method did not seem useful to me to evaluate service-dominant business models*
Perceived ease of use	5	It would be easy for me to apply the evaluation questions to support the evaluation of service-dominant business models
	6	It was not clear to me what certain questions meant or how these questions related to the service-dominant business model*
	7	It would be difficult for me to apply the method to support service-dominant business model evaluation*
	8	It was clear to me how the method should be used
Intention to use	9	If I would design a new service-dominant business model, I would use the method to support the validation and evaluation of design choices
	10	I would not use this method to support the evaluation of service-dominant business models*

Questions indicated by a star (*) are deliberately reversed

Out of the 8 participants that were involved, 5 filled out the questionnaire. The results of the responses are illustrated in Table 8.

Table 8: Responses to questionnaire for utility of the method

Criteria	Question	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Perceived usefulness	1	0	0	0	2	3
	2	0	0	0	2	3
	3*	0	1	1	2	1
	4*	0	0	0	1	4
Perceived Ease of Use	5	0	0	1	2	2
	6*	0	0	1	2	2
	7*	0	0	0	3	2
	8	0	0	0	3	2
Intention to Use	9	0	0	0	2	3
	10*	0	0	0	1	4

For questions indicated with a star (*), the responses are reversed.

Perceived usefulness

With respect to *perceived usefulness*, the results illustrate that the practitioners considered (the application of) our method to be useful, given the predominantly high values associated to these related questions. This was also motivated by some of the quotes that we captured through the semi-structured interviews or surveys:

"Creating valuable insights into the working of the model and the stakes of each actor." [Practitioner 1]

"A simple and quick check to validate the working and choices for the business model." [Practitioner 3]

"The need to look at the business model from different angles which secures a more structured outcome for the evaluation." [Practitioner 4]

However, we see that in terms of question 3 (*I felt I missed questions to effectively evaluate a service-dominant business model*) a wider spread of responses is given, which indicates that although we offer a set of 21 questions to evaluate design elements and decisions of service-dominant business models, more support can be provided. For instance, question 17 aims to evaluate whether the costs and benefits can be balanced. However, particularly in early phases of the innovation process, it can be difficult to identify all costs and benefits or be able to specify them accurately:

"So far all are listed. However, during the process of the designing a process model, more costs and benefits can be listed. Also, a more detailed quantitative cost/benefit analysis is needed to really address the problem correctly." [Practitioner 7]

Although this specific example addresses a concern outside of the scope of this method (e.g., quantitative cost-benefit analysis (Gilsing, Turetken, Ozkan, Slaats, et al., 2020)), the method should take away uncertainty with respect to the business model design and enable decision makers to reflect on design decisions. This need for information, particularly with respect to the future outcomes of the model, should be further fostered through our method, or through the deployment of multiple joint methods, such as scenario analysis (Tesch, 2016) or roadmapping (Haaker et al., 2017).

With respect to the application of the method, participants also indicated that to effectively support decision making on the design of service-dominant business models, all relevant stakeholders should be present:

"Need for the participation of all stakeholders to create buy-in when applying the method." [Practitioner 1]

As the design of the model is a collaborative activity, design decisions with respect to all listed stakeholders should be evaluated, which should be considered in light of the strategic concerns or motives of the respective stakeholder.

Perceived ease-of-use

With respect to *perceived ease-of-use*, the results are generally positive, although the average is lower than for perceived usefulness. This is also reflected by some of the quotes generated:

"Asking and scoring questions is familiar to people." [Practitioner 6]

"The method is simple, making it easy to understand." [Practitioner 7]

However, some participants indicated that the application of the questions was not fully clear, or that more explanation was needed to understand how the questions should be answered, affecting the ease-of-use of the method:

"It takes some time to fully understand the model and maybe it makes sense to have a more in-depth explanation with respect to the method." [Practitioner 4]

"There is a need for understanding the implications of the questions with respect to the model." [Practitioner 5]

"Some examples or cases would be helpful to help use of questions." [Practitioner 3]

Perceived intention-to-use

Lastly, with respect to *perceived intention-to-use* the results generally are positive. Throughout our case studies, participants in general noted that using such a method would help them to better understand and guide the design of their service-dominant business models.

Although the set of participants was limited - meaning that care should be taken for drawing conclusive results -, we observe that the utility of the method generally was deemed positive. The initial set of results indicate that our method supports the evaluation of service-dominant business model designs and helps users to shed light on design decisions made with respect to the corresponding business logic. However, to improve the usability of the method, additional support may be presented with respect to how the questions should be interpreted. As an extension of the current scope of the method, this may also include explicating what implications each question may bring forward with respect to the business model design, offering further support to the task of business model redesign.

6 Conclusion

As a result of an increasingly globalized and interconnected world, the boundaries of markets increasingly fade or become vague, requiring organizations to cope with increased challenges of establishing novel value propositions and sustaining competitive advantage. In response, we see that many organizations adopt a service-orientation to extend or enhance value propositions, or as a means to establish more long-term relationships with customers (Kowalkowski et al., 2017; Ostrom et al., 2015). In addition, organizations engage in collaborative networks or service ecosystems to better cater to contemporary customer needs and to reduce service complexity (Böhmann et al., 2014). To support the design and development of such systems, the business model concept is frequently used (Blaschke et al., 2019; Böhmann, Leimeister, & Möslein, 2018) explaining the configuration and logic by which value is co-created. Although research has focused on supporting the design of the resulting service-dominant business models through tooling, limited work is available on their evaluation to support design decision-making and to assess its preliminary or expected performance. A lack of such evaluation support as a result, may threaten viability of such service ecosystems and their long-term success (Schulz, Böhm, Gewald, Celik, & Krcmar, 2020).

In response, we focused on developing a method that can be used by (a network of) organizations to evaluate the design of their service-dominant business models. The method consists of a set of guiding questions generated through analyzing theory on SDL and a procedural description with respect to their application. Our application of our method in a real-life mobility business case and evaluation of its validity and utility provide evidence that the proposed method enables decision makers to reflect on design decisions with respect to a service-dominant business model design, and to assess whether its structure is valid when it is considered through the lens of SDL. Moreover, the method enables decision makers to evaluate the performance of the business model design in a qualitative sense, leveraging business model quality attributes such as viability, feasibility and robustness.

6.1 Contributions to research

Our work has important contributions to research. First and foremost, our work contributes to the body of knowledge on service systems engineering by offering guidance and tooling towards the design and evaluation of service ecosystems (Böhmann et al., 2014). Specifically, leveraging the business model concept as a means to describe the configuration of such service ecosystems, we make explicit how, in a qualitative sense, service ecosystems can be evaluated and what elements or characteristics are important with regards to the configuration of such systems. Such practices of evaluation are essential to guide the effective design and development of service ecosystems and in turn can help improve their long-term viability and survivability (Böhmann et al., 2018; Schulz, Böhm, Gewald, Celik, & Krcmar, 2020). Considering domains increasingly characterized by a service-dominant mindset, such as the mobility domain (Schulz, Gewald, et al., 2020; Turetken et al., 2019) or IT domain (Österle, Buchwald, & Urbach, 2016), our method therefore may contribute towards establishing more sustainable and viable solutions in such domains.

Second, our method contributes towards the instantiation and realization of the practical use of SDL, which predominantly has resided on a conceptual or meta-theoretical level of discussion (Blaschke et al., 2019; Schulz, Gewald, et al., 2020; Vargo & Lusch, 2017). For our method, we operationalize the implications of SDL into concrete guiding questions that can be used to assess whether the structure of a service ecosystem is appropriate. Accordingly, our method fosters the operationalization of a service-dominant mindset into the business logic of organizations partaking in service ecosystems. In addition, we further support work on the conceptual integration of SDL and business models (Clauß et al., 2014; Kindström, 2010), clarifying how the implications of SDL may impact business model design and evaluation. As a result, our work can help researchers to better understand the configuration of service-dominant business models which are becoming increasingly prevalent.

Lastly, as we have demonstrated and evaluated our method through a real-life case positioned in the mobility domain, our work contributes to the call and increased use of the business model concept to understand value (co-)creation in mobility settings (Willing, Brandt, & Neumann, 2017). Our work demonstrates the use of the business model concept to explore how a platform-based service solution to address (intermodal) mobility problems can be supported through the configuration of the service ecosystem, and how the resulting business model design consequently can be evaluated in light of the different motivations and challenges perceived by the stakeholders involved. Accordingly, our work offers empirical insights for the use and evaluation of business models in practice to address mobility challenges and to help in structuring the surrounding ecosystem.

6.2 Contributions to practice

Our work has several practical implications. First, our method supports the qualitative evaluation of service-dominant business model designs, enabling organizations in service ecosystems to reflect on their design decisions and to collaboratively assess whether the structure or configuration of a service ecosystem is adequate. Accordingly, use of the method supports organizations in capturing the motivations and requirements of all stakeholders involved, thus making more informed design decisions. In turn, this should support the long-term viability and success of such business initiatives (Schneckenberg et al., 2017; Schulz, Böhm, Gewald, Celik, & Krcmar, 2020). This is particularly

relevant for the mobility domain, for which it is key to complement IT innovations to address mobility challenges through a context or business model analysis to understand the needs and requirements of the stakeholders involved (Gilsing et al., 2018; Turetken et al., 2019). In addition, as the method is qualitative in nature, its application may significantly benefit organizations in developing business models in early phases of the innovation process. Such phases are typically characterized by significant uncertainty with regards to the outcomes and performance of the business model design (McGrath, 2010), making it difficult to determine how the business model should be configured. Our method can be used here as guidance, offering structure support in terms of the challenges faced with respect to the configuration of the business model design (*structural validity*), as well as the factors to consider in terms of its expected performance (*viability, feasibility* and *robustness*).

6.3 Limitations and avenues for future research

Our research is not without limitations. First, to design our proposed artifact, we have built upon the theory of SDL and examined what implications it has for business model design and evaluation. These implications served as the basis for the generation of our guiding questions. Although we carefully and thoroughly analysed the body of knowledge on SDL, and successfully evaluated the proposed artifact through a real-life representative business case, we cannot argue that the resulting set of questions is exhaustive or complete. As a future work, more applications of the method in real-life cases will help us to demonstrate sufficient completeness of the questions incorporated in the method. In this light, it is also valuable to analyse what questions are most frequently used or most commonly lead to valuable discussions or improvements with regards to the business model design. Additionally, it is also important that such applications are supported through all represented stakeholders for the ecosystem. Although the case we used is strongly representative of the problem context, featuring in a domain increasingly characterized by a service-dominant mindset (Böhmann et al., 2014), not all stakeholder roles in the ecosystem were represented for the application of the method. Although the business model designed for the workshop was explorative (i.e., to get a general understanding of how such a solution can be offered) and the stakeholders present had a relatively good understanding of the different motivations of the stakeholders in the ecosystem (thus being able to apply and answer the guiding questions), all stakeholders should be present to fully understand the completeness and validity of the method.

As a second limitation, we have only considered service-dominant business models that have been designed by means of the SDBM/R (Turetken et al., 2019). Although our proposed artifact is tool independent (i.e., it is in principle applicable to any service-dominant business model), we only demonstrate the validity of our method through the models designed using the SDBM/R. The evaluation of the validity of our artifact can be further supported by application of our method to service-dominant business models designed using other approaches or techniques. In this light, research may also focus on extending on our method, specifically with respect to how the redesign of business models as a result of method application can be supported, either by generating a list of possible, standardized resolutions to address problems encountered for guiding questions, or establishing best practices to guide practitioners with regards to service-dominant business model redesign.

As service solutions are at the core of service ecosystems and as such serve as the starting point for any novel business model, future research should explore the interface between service engineering and business model engineering (Engel & Ebel, 2019). Specifically, research may focus on how the design and evaluation of service-dominant business models is accommodated or complemented by the design and evaluation of the underlying service solution, and to strive for integrated methods and techniques that accordingly can advance the conceptualization and design of service ecosystems.

Additionally, research should focus on the *quantitative evaluation* of service-dominant business models to support the development of service ecosystems, particularly important in the later phases of the innovation process. Such support can help both researchers and practitioners to better understand or assess the long-term viability of service ecosystems, in turn contributing to their systematic design and development, and facilitating a better understanding of how service ecosystems should be configured.

Given the collaborative and networked nature of the resulting business models, such evaluation support should focus not only on the financial aspects of business model, but also on non-financial outcomes, such as environmental or social benefits, in order to adequately address how value is created and captured in such ecosystems (Freudenreich, Lüdeke-Freund, & Schaltegger, 2019).

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