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A METHOD FOR QUALITATIVE EVALUATION OF SERVICE-DOMINANT BUSINESS MODELS

Research paper

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Abstract

The widespread deployment of digital technologies has driven many contemporary organisations to adopt a service perspective as a means to extend their business practices or to cater to customer needs. To reduce service complexity, organisations engage in collaborative networks to exchange and integrate resources from many concurrent actors to co-create value. As a consequence, in contrast to firm-centric business models, the resulting service-dominant business model becomes networked in nature, describing the logic of how many concurrent actors co-create value and exchange resources. As business models take a pivotal position with respect to organisational performance and business-IT alignment, this places significant emphasis on the valid design and subsequent evaluation of these models, taking into account these service-dominant characteristics. However, we see that limited work is available to support business model evaluation from a service-dominant perspective, to address these concerns, design decisions and the resulting quality of the model. In response, this paper proposes a method for the qualitative evaluation of service-dominant business models. Following a design science research methodology, we have iteratively designed the method supported by theory on service-dominant logic, business model design and business model evaluation. We illustrate the application of the method by means of a case study.

Keywords: service-dominant business models, business model evaluation, service-dominant logic, business model design

1 Introduction

The dawn of the digital era has led to an interconnected, digitised world of business, offering contemporary organisations a vast amount of opportunities to leverage digital technologies to support their business activities (Engel and Ebel, 2019). To this end, we see that many organisations shift away from a traditional goods-dominant logic towards a service-dominant logic (Vargo and Lusch, 2017), and offer digitally-enabled services as means to extend their current value propositions or to foster long-term customer relationships (Ostrom *et al.*, 2015; Blaschke *et al.*, 2017; Engel and Ebel, 2019). To offer these typically complex service propositions, organisations engage in service ecosystems, enabled by digital technology, in which resources are exchanged and integrated towards the provision-

ing of services and to propose novel value to the customer (Böhmann, Leimeister and Möslein, 2014). Prominent organisations such as Spotify, Airbnb or Netflix leverage digital platforms to bring together partners and that facilitate the integration and exchange of services (Täuscher and Laudien, 2018). Similarly, in the mobility domain, we see that digital technologies such as IoT are used to connect and integrate the resources of many collaborating partners to offer enhanced services to the end-user (Gilsing *et al.*, 2018; Turetken *et al.*, 2019). In light of these developments, we observe that research increasingly has focused on conceptualising how organisations, driven by digital technology, collaborate in service ecosystems and networks as a means to co-create value for the customer (Böhmann, Leimeister and Möslein, 2014; Lusch and Nambisan, 2015; Ostrom *et al.*, 2015; Engel and Ebel, 2019). To this end, the service-dominant logic (SDL) paradigm is often used to explain how organisations offer services and interact in service networks (Vargo and Lusch, 2008, 2017).

At the macro-level, the *business model* concept is frequently used to describe and conceptualise how organisations collaborate in service ecosystems, how resources are exchanged and integrated, and how value is co-created (Clauß, Laudien and Daxböck, 2014; Blaschke *et al.*, 2017). Business models can be defined as the logic of how value is created and captured (Osterwalder and Pigneur, 2010). Business models in essence are visual or verbal representations that facilitate the communication of the business logic and functions (Burkhart *et al.*, 2011). Business models are argued to influence organisational performance (Casadesus-Masanell and Zhu, 2013) and are considered to bridge the gap between strategy and operational processes (Al-Debei and Avison, 2010) which calls for the valid and viable design of business models (Veit *et al.*, 2014). To this end, several tools have been proposed to support the design and representation of *service-dominant* business models (Zolnowski, Weiß and Böhmann, 2014; Turetken *et al.*, 2019).

Designing new business models however is a gradual process characterised by significant uncertainty, particularly in the early phases of the design process (McGrath, 2010). Accordingly, preliminary business model designs should be evaluated with respect to their design decisions and quality, to motivate further innovation and exploration. In these early phases of design, qualitative evaluation approaches are advocated to support business model evaluation, as quantitative support in the form of data is typically unavailable or uncertain (Tesch and Brillinger, 2017). In contrast to traditional business models, which take the perspective of the focal organisation (Nenonen and Storbacka, 2010; Bankvall, Dubois and Lind, 2017), the nature of service-dominant business models calls for a careful, networked evaluation of the business model design, featuring the logic of how value is co-created, the concurrent interactions and exchanges that take place between stakeholders and how value is captured (Hakanen and Jaakkola, 2012; Turetken *et al.*, 2019). However, we see that limited work is available on business model evaluation that explicitly takes these characteristics into account. For instance, although qualitative evaluation methods exist towards business model evaluation (Mateu and March-Chorda, 2016; Diaz-Diaz, Muñoz and Pérez-González, 2017; Haaker *et al.*, 2017), these methods focus solely on the assessment of the focal organisation and do not cover or address the exchanges between and needs of concurrent actors in the service-dominant business model. Accordingly, there is a need for a method to evaluate service-dominant business models, in order to guide their effective design process. Hence, *our research objective is to develop a method for the qualitative evaluation of service-dominant business models.*

In this paper, we propose a method for the *qualitative* evaluation of service-dominant business models at the *early* phases of business model design. The method consists of a normative framework with guiding questions that help practitioners to (re)evaluate design decisions from the perspective of service-dominant business, to which we structure the guiding questions on the basis of quality attributes used for business model evaluation. The questions are derived from the implications of SDL for business model design and business model evaluation, synthesising how SDL impacts service-dominant business models. We have followed a *design science research methodology* (Peffers *et al.*, 2007) to guide the steps taken for our research process, whereas *situational method engineering* is used to structure the artefact design steps (Ralyté, Deneckère and Rolland, 2003). We illustrate the application of the method by means of a case study in the mobility domain, to which we evaluate its initial validity (Gregor and Hevner, 2013).

The proposed method contributes to research on the conceptualisation of service ecosystems by bridging the gap between service-dominant business models (as a representation of service ecosystems) and business model evaluation, presenting a novel method that can be used as a lens to evaluate service systems. As for practice, our method supports practitioners in evaluating design decisions made with respect to a service-dominant business model and in assessing the qualitative performance of the business model design, such that decision making can be structured.

The remainder of this work is structured as follows. Section 2 describes the background and relevant literature. Section 3 elaborates on the methodology and design process followed. Section 4 discusses the design requirements of the artefact and its derivation. The application of the artefact is illustrated in Section 5 through a case study. The paper is concluded with the discussion of the main implications of this article for research and practice and the avenues for future work.

2 Research background and related work

This section discusses the research background and related work with respect to our research. Specifically, we elaborate on the *service-dominant logic* paradigm, *service-dominant business model design* and *the evaluation of service-dominant business models*.

2.1 Service-dominant logic

Service-dominant logic (*SDL)* is considered the successor of *goods-dominant logic (GDL)* and emphasises thinking in terms of service as the basis for value co-creation (Vargo and Lusch, 2008, 2017). In contrast to GDL, which considers that value can be created and embedded through the characteristics of offered goods or products, SDL considers that value creation solely lies at the customer side, and depends on the perception or experience a customer has with respect to using the offering (Grönroos, 2011). Accordingly, in order for an organisation to influence value creation, it must shape the context in which the offering is used and support the customer in the value creation process, which organisations do so through providing *service* (Vargo, Maglio and Akaka, 2008; Grönroos and Ravald, 2011). The implications of SDL for organisations are captured in 5 axioms, which are listed in Table 1 (Vargo and Lusch, 2016).

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		

Table 1. Axioms of service-dominant logic

2.2 Service-dominant business models and design

A business model can be defined as the logic how an organisation creates, appropriates and captures value (Osterwalder and Pigneur, 2010), how it is structured through internal and external activities (Zott and Amit, 2010) and how it is supported through IT (Veit *et al.*, 2014). Several componentisations of business models have been defined (Morris, Schindehutte and Allen, 2005; Al-Debei and Avison, 2010; Osterwalder and Pigneur, 2010). For instance, Al-Debei & Avison (2010) structure business models through the components *value proposition*, *value finance*, *value network* and *value architecture*. *Value proposition* describes the service or product offered, the value elements or propositions contained with this offering, the customer segment it is offered to and how or why the offering may be beneficial. *Value finance* defines the costs and benefit structure of the organisation and network. *Value network* represents the configuration of roles within the business network, the means of governance and communication as well as the relationships between network stakeholders. Lastly,

Value architecture describes the organisational and technical configuration of the organisation, comprising the tangible and intangible resources deployed to generate value propositions.

Adopting an SDL perspective has significant implications for the configuration of the respective business models. Given the explicit customer-orientation and related service complexity as a result of SDL, these business models become networked focused, to bring together organisations to integrate resources and technologies towards the co-creation of value (Kindström, 2010; Blaschke *et al.*, 2017). Therefore, designing new service-dominant business models entails the establishment of networks of actors including the customer, the exploration of how value can be co-created through the integration and combination of resources, and supporting actor-actor interactions by means of digital technologies (Hakanen and Jaakkola, 2012; Clauß, Laudien and Daxböck, 2014).

Several tools have been proposed for the representation of *service-dominant* business models to guide the design process. For instance, Zolnowski, Weiß, & Böhmann (2014) propose the Service Business Model Canvas, which takes the key elements of the Business Model Canvas (Osterwalder and Pigneur, 2010) as a basis and transforms these to a service-dominant perspective, accommodating a networked perspective and explicit value co-creation. Similarly, Turetken et al. (2019) propose the Service-Dominant Business Model Radar (SDBM/R), which takes the expected value-in-use for the customer generated by the business model design at its centre. Consequently, through its circular representation, it facilitates users to model how each actor in the network contributes to value-co-creation by means of their value propositions. In addition, it shows the respective actor activities and the actor costs and benefits that may emerge from participation. Given these characteristics and the explicit networked orientation of SDBM/R, we selected to use SDBM/R for the remainder of this work to design and illustrate service-dominant business models. The template for SDBM/R is presented in Figure 1.

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

2.3 Service-dominant business model evaluation

Iterations of business model design should be accommodated by an evaluation step to evaluate design decisions and to motivate continued innovation (Zott and Amit, 2015). Business model evaluation is defined as the activity of assessing the performance of business models (Brea-Solís, Casadesus-Masanell and Grifell-Tatje, 2015). Although business model evaluation can be applied at design time (*ex-ante*) or at run-time (*ex-post*), in this paper, we focus on the *ex-ante* evaluation of business models. In the relevant literature, business model performance is often expressed in quality attributes such as *business model structural validity*, *business model feasibility*, *business model viability* or *business model robustness* (Brea-Solís, Casadesus-Masanell and Grifell-Tatje, 2015; Schrauder *et al.*, 2018; Täuscher and Abdelkafi, 2018). Such quality attributes can be used to evaluate the performance of novel business model designs, to which service-dominant business models are no exception.

Although service evaluation (such as data-driven evaluation approaches) is relevant to any business model design, we consider business model evaluation as the context to service evaluation, understanding the collaboration and exchange between actors (Engel and Ebel, 2019). In contrast to GDL, for which business model evaluation is considered from the perspective of the focal organisation, the evaluation of service-dominant business models depends on the joint consideration of all stakeholders in the business model, as each stakeholder concurrently adds value towards the central value-in-use (Grefen *et al.*, 2015; Turetken and Grefen, 2017). This extends to assessing the logic of how value is exchanged, appropriated and captured within networks, and how resources are exchanged and integrated. Accordingly, quality attributes used to support service-dominant business model evaluation should capture and address these characteristics in order to be effectively applied. Examining existing studies on business model evaluation, we see that although many qualitatively-oriented methods (Mateu and March-Chorda, 2016; Diaz-Diaz, Muñoz and Pérez-González, 2017; Haaker *et al.*, 2017) exist, we see that these methods lack a service-orientation and typically evaluate business models from the perspective of the focal organisation. As a consequence, these methods do not address the exchange and integration of resources at the network level, constituting the essence of service-dominant business models. As such, it becomes difficult to effectively evaluate design decisions with respect to service-dominant business models and to assess the projected business model performance.

3 Research design

To develop the proposed artefact, we followed the *design science research paradigm* (Hevner *et al.*, 2004). To structure our research process, we follow the operationalised steps proposed by Peffers et al. (2007). Accordingly, we identify the following research steps: *problem identification, definition of artefact objectives, design of artefact as a solution* and *demonstration and evaluation*. An overview of the research process is presented in Figure 2. We detail each step in the subsequent sections.

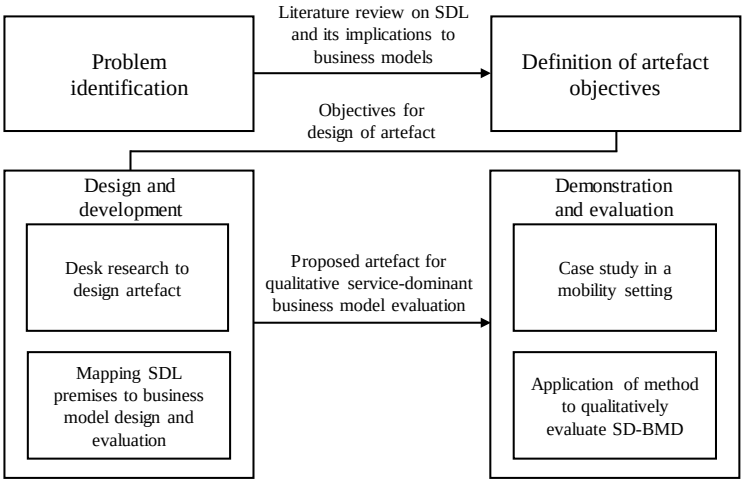

Figure 2. Research design

3.1 Problem identification

We discussed the research problem central to our work in the introduction of this paper. We can summarise it as follows: although SDL enables organisations to capture the benefits of digital technology, adoption of SDL causes business models of the organisation to become more complex and network-focused featuring many concurrent stakeholders and concerns. This poses increased requirements on the valid design and subsequent evaluation of service-dominant business models. However, limited support in terms of methods is present in the literature that effectively addresses the evaluation of these business models. To fill this gap, we have developed a method as a design artefact that supports the qualitative evaluation of service-dominant business models.

3.2 Definition of artefact objectives

Given the identified problem, it is evident that in order for the artefact to be effective for service-dominant business model evaluation, the artefact should be grounded on the SDL premises (Vargo and Lusch, 2008), such that it becomes apparent how SDL may influence business model design and its quality attributes. Accordingly, our first design objective is:

Obj1: The proposed method should consider the implications of SDL on business model design

As the primary goal of the artefact is to facilitate users to evaluate service-dominant business model designs (SD-BMD), the implications of SDL for business model design should be expressed in and translated to quality attributes relevant for business model evaluation (e.g., structural validity, feasibility, viability and robustness) (Brea-Solís, Casadesus-Masanell and Grifell-Tatje, 2015; Haaker *et al.*, 2017; Schrauder *et al.*, 2018). Therefore, the artefact should translate the implications of SDL for business model design into attributes of business model performance. As such, our second design objective is:

Obj2: The proposed method should facilitate its users to evaluate a SD-BMD with respect to its structural validity, feasibility, viability, and robustness.

Lastly, the artefact should enable users to evaluate SD-BMDs with respect to their design decisions and its projected performance for the stakeholders involved. As business model exploration, especially in early phases of design, brings uncertainty with regards to decision making for which not all outcomes can be quantified (McGrath, 2010; Dellermann *et al.*, 2019). Therefore, the method should produce qualitative insights to increase the flexibility of its application. Therefore, our last design objective is as follows:

Obj3: The proposed method should produce qualitative insights

3.3 Design and development

To provide structure to the design of our artefact, we have followed a *situational method engineering (SME)* approach (Brinkkemper, 1996; Ralyté, Deneckère and Rolland, 2003). Based on our proposed method, we identify the following sequential design strategies: *"1. from scratch strategy", "2. extension-based strategy", "2.1 domain-driven strategy", and "2.2. pattern-based strategy"*. As no method currently exists that adequately addresses service-dominant business model evaluation, we design a method from scratch. To satisfy the need for qualitative support (in line with objective 3), we use guiding questions as a method basis, often used to support qualitative business model evaluation (Osterwalder and Pigneur, 2010; Dellermann *et al.*, 2019). Next, we follow an *extension-based strategy* and subsequent *pattern-based strategy* to combine theory on business model design, business model evaluation and SDL to extent the base method towards service-dominant business model evaluation grounded on these principles (in line with objectives 1 and 2). The design inputs and outputs for developing the artefact is detailed in Figure 3. We started from theory on business model evaluation and business model design to derive the context for the set of questions to support service-dominant business model evaluation. On the basis of this, we derive the quality attributes *feasibility, viability, robustness* and *structural validity* used to support business model evaluation. We used the componentisation proposed by Al-Debei & Avison (2010) to further detail *structural validity*. We should note that for our method, we changed *value finance* into *value capture* to address the neutral perspective of SDL. Next, we explored the implications of SDL (Vargo and Lusch, 2008) in light of these quality attributes to understand how SDL impacts business model design and evaluation. Per quality attribute, we therefore examined how this attribute would require additional considerations (as opposed to traditional business models) to accommodate SDL. On the basis of the resulting implications, we derive guiding questions that address the concerns of service-dominant business models and support its qualitative evaluation (see Section 4). The design process was iterative in nature for which five researchers, with backgrounds in service-dominant business, (the authors of this paper) were included.

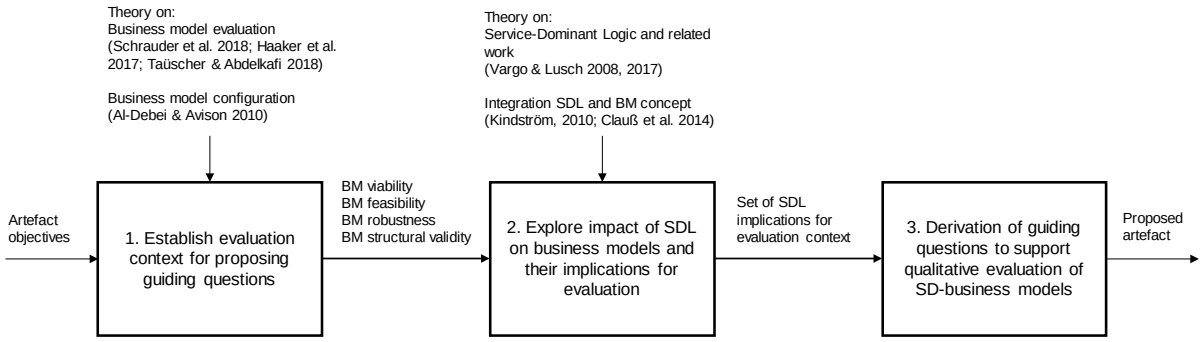

Figure 3. Design process for proposed evaluation artefact

3.4 Demonstration and evaluation

We demonstrate the method by means of its instantiation in which we evaluate the validity of the artefact (Gregor and Hevner, 2013). The instantiation features in a digitally-enabled mobility setting in a city in the Netherlands, in which the city sought after a solution to decrease traffic problems in cases when several large events were held in a particular region of the city. To address this problem, a business model workshop was previously held to design a business model with relevant stakeholders, reasoning from a service-dominant, networked perspective. The resulting business model design (represented through the SDBM/R and published in Turetken et al. (2019)) should consequently be evaluated to motivate the concretisation and implementation of this design. To this purpose, our method was applied. For application of the proposed method, we involved two of the stakeholders present at the initial workshop to apply the artefact, and examined the changes that emerged with respect to the business model design.

4 Method for the qualitative evaluation of service-dominant business models

Our analysis of the implications of SDL with respect to quality attributes for business model, such that service-dominant business model evaluation is supported, has resulted in 21 questions that enable users to qualitatively evaluate a SD-BMD as a method. Sets of questions are grouped based on the quality attribute they address. As mentioned, these quality attributes are *structural validity*, *feasibility*, *viability and robustness*.

With respect to the questions, we provide different degrees of freedom as to how they can be answered, based on the respective quality attribute. For structural validity, the questions focus on validating whether the SDL principles have been followed for the to-be evaluated business model design and whether the general logic of the business model is valid. Accordingly, questions related to the structural validity are stated in a *closed* form (in the form of binary, '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. On the other hand, for the quality attributes of feasibility, viability and robustness, we provide increased degrees of freedom for the answers of related questions in the form of Likert items (note that some items are inverted). Note that, due to the interrelated nature of business model components, questions requiring adjustments 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 process.

In the following sections of this chapter, we go through the set of questions derived per quality attribute (i.e., structural validity, feasibility, viability and robustness), and provide justification for their need and relevancy.

4.1 Questions for structural validity

For evaluating the structural validity of service-dominant business models, we assess the implications of SDL on business model design. The set of evaluation questions is presented in Table 2. Given its explicit link to business model design, we sub-divide the questions with respect to the componentisation of business models (Al-Debei and Avison, 2010), namely: value creation, value architecture, value network and value capture. Next, we discuss the questions with respect to these components.

A major implication of the adoption of SDL is that, rather than the traditional supplier-customer relationships in which products are exchanged, organisations engage in service systems to deliver the complex services needed, changing the *value network* (Vargo and Lusch, 2008; Vargo, Maglio and Akaka, 2008; Maglio *et al.*, 2009). As a result, service-dominant business models should always be networked (Clauß, Laudien and Daxböck, 2014). To verify this property in the design of the business model, we pose *Q1*. If we consider the importance of the role of the customer in the network (Vargo and Lusch, 2008), we can conclude that the customer should always be considered as an explicit party involved in the co-creation of value (*Q2*). Next, SDL postulates organisations as resource integrators that exchange service to create value in service systems (Vargo and Lusch, 2008; Maglio and Spohrer, 2013). Hence, within a value network of a business model, no actor can act in isolation (Nenonen and Storbacka, 2010), leading to *Q3*. Lastly, in contrast to the value chain of GDL, which can be expressed by a set of hierarchical relationships between suppliers and customers (suppliers have customers which sequentially may be the suppliers of other customers), the collaborative networks central to SDL are multi-directional (Grönroos, 2011; Hakanen and Jaakkola, 2012; Clauß, Laudien and Daxböck, 2014). This necessitates a heterarchical relationship. As actors in SD-BMD co-create value, their interactions should therefore occur on the same level of hierarchy (*Q4*).

		Evaluation questions	Label	Response	
Business model 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 other 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 value-in-use realistically follow from the set of value propositions?	Q5	No	Yes
		Does the value-in-use address the need of the customer?	Q6	No	Yes
	Value architecture	Does each actor value proposition realistically result from its deployed resources?	Q7	No	Yes
		Does the service enable the value creation process of the customer?	Q8	No	Yes
	Value capture	Does each actor have at least one cost and one benefit in the SD-BMD?	Q9	No	Yes
		Are all transferred and generated costs and benefits listed in the SD-BMD?	Q10	No	Yes

Table 2. Evaluation questions related to business model structural validity

According to SDL, value is always determined by the customer, leading to the customer being a co-creator of value (Vargo and Lusch, 2008; Grönroos, 2011). An organisation, therefore, can only generate *value propositions* (Lusch, Vargo and O'Brien, 2007). Moreover, as organisations operate in service systems to deliver complex services, the set of value propositions (including the value added by the customer) determines the value-in-use generated by means of the business model (Hakanen and Jaakkola, 2012) (*Q5*). This value-in-use accordingly should be beneficial to the customer in the context for which it is used (*Q6*).

For the *value architecture*, adopting an SDL perspective leads to networks of organisations collaboratively creating value with the customer, for which each actor delivers part of the value created (value propositions) (Hakanen and Jaakkola, 2012). These value propositions should be enabled or supported by actors' technical and organisational architecture (Böhmann, Leimeister and Möslein, 2014; Lusch and Nambisan, 2015). This necessitates the need verify if the respective deployed resources realistically lead to the proposed value proposition (*Q7*). Furthermore, as the customer is considered essential

for the co-creation of value through use of the service (Vargo and Lusch, 2008; Grönroos, 2011), it should be verified that the service enables the customer to create value (*Q8*).

Organisations in service networks strive for mutual betterment (Vargo and Lusch, 2008; Lusch and Nambisan, 2015). Therefore, each actor in a business model always contributes value in order to receive value, leading to the concept of *value capture*. As actors in service systems do not act in isolation but exchange services to create value (Maglio and Spohrer, 2013), every actor, in terms of a business model design, should at least incur some cost and get some benefit (given the mutual beneficial nature of service exchange). This is assessed through *Q9*. Moreover, the design should be verified to ensure that all costs and benefits that are transferred between actors, as a result of service exchange, are indicated for the respective actors, leading to *Q10*.

4.2 Business model feasibility

Adopting SDL brings forward additional operational and resource challenges with respect to cooperation in business networks that require a careful consideration of the projected feasibility. The set of evaluation questions relevant to assess the feasibility of SD-BMDs is presented in Table 3.

As in the case for the evaluation of traditional business models, it is necessary to assess if the required resources are currently available to the organisations or to what extent organisations have access to these resources to support their respective activities (*Q11*). In addition, the structure of the interactions and relationships between actors in service systems should also be assessed. Specifically, service exchanges between actors to co-create value requires both information and resource flows and relevant interfaces to be established (Nenonen and Storbacka, 2010; Hakanen and Jaakkola, 2012; Clauß, Laudien and Daxböck, 2014). Therefore, the feasibility of service-dominant business models depends on to the extent to which these interfaces are available or can easily be established (*Q12*). Similarly, the extent to which the operationalisation of the business model depends on legal and technological barriers should be evaluated (*Q13*). Given the possibility that network actors are geographically dispersed, it might become important to evaluate the influence of legal or technologic barriers that may impede or hamper the operationalisation. Finally, the degree of trust between network actors or understanding of partner operations should also be evaluated (Hakanen and Jaakkola, 2012; Clauß, Laudien and Daxböck, 2014). Although service systems can be collaborations of temporary nature, and are, therefore, not necessarily based on long-term relationships, (Maglio *et al.*, 2009), a lack of understanding of processes of partners or even a lack of trust may hamper information exchange within the network, which as a result may affect the feasibility of the business model (*Q14*).

	Evaluation questions	Label	Response				
Business model feasibility	To what extent does each actor in the SD-BMD have access to resources needed to conduct its activities?	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 do legal and technological barriers exist towards implementation of the SD-BMD?*	Q13	Very low	Low	Moderate	High	Very high
	To what extent does trust or cooperation exist between actors in the SD-BMD?	Q14	Very low	Low	Moderate	High	Very high

Table 3. Evaluation questions related to business model feasibility (= inverted)*

4.3 Business model viability

As the proposed value-in-use is co-created when the set of actor-value propositions are combined (Nenonen and Storbacka, 2010; Hakanen and Jaakkola, 2012), the *viability* of a service-dominant business model does not merely depend on the bilateral relationship between the customer and focal organisation, but also on how value is appropriated to all actors in the business model (Turetken *et al.*, 2019). Similarly, service exchange should also result in the betterment of both parties involved in the exchange. The set of questions relevant for the evaluation of the viability of SD-BMD is presented in

Table 4. Accordingly, the business model should be evaluated for the extent that the costs and benefits per actor can be measured or quantified (*Q15*) and can be balanced (*Q16*). Moreover, it should be assessed to what extent strategic objectives are satisfied through business model participation (*Q17*).

	Evaluation questions	Label	Response				
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 can the costs and benefits per actor in the SD-BMD realistically be balanced?	Q16	Very low	Low	Moderate	High	Very high
	To what extent does the SD-BMD satisfy the strategic goals of each actor?	Q17	Very low	Low	Moderate	High	Very high

Table 4. Evaluation questions related to business model viability

4.4 Business model robustness

The questions posed for the evaluation of the robustness of SD-BMD are directed at capturing and understanding the uncertainty incurred in the business model design along its core components and the extent of tolerance it has for the design changes and variations (Haaker *et al.*, 2017). Table 4 presents the set of questions incorporated in the method for the evaluation of business model robustness. To assess the robustness of the *value network*, *Q18* evaluates the extent that each actor in the business network is replaceable, or the extent that a concrete actor can be replaced by a different actor that satisfies the same or similar role. To evaluate the robustness of *value capture*, *Q19* assesses the extent that the projected costs and benefits of each actor are subject to risks or uncertainty. For the evaluation of the robustness of the *value proposition*, *Q20* assesses the extent that the offered service solution may, in its current form, address different customer segments. The final question (*Q21*) assesses the robustness of the *value architecture*, by questioning the extent that the resources available to conduct the actor activities are subject to technological or legal developments, to evaluate the degree of the influence of a change in the technology on the operationalisation of the business model.

	Evaluation questions	Label	Response				
Business model robustness	To what extent can network actors in the SD-BMD be substituted or replaced?	Q18	Very low	Low	Moderate	High	Very high
	To what extent are the costs and benefits listed per actor in the BMD subject to risk and uncertainty?*	Q19	Very low	Low	Moderate	High	Very high
	To what extent can value-in-use of the SD-BMD be offered or catered to different customer segments?	Q20	Very low	Low	Moderate	High	Very high
	To what extent are the actor activities subject to technological or legal developments?*	Q21	Very low	Low	Moderate	High	Very high

Table 5. Evaluation questions related to business model robustness (= inverted)*

5 Application of the proposed artefact to evaluate service-dominant business model design

To demonstrate the validity of our method (Gregor and Hevner, 2013), we have instantiated the artefact in a digitally-enabled mobility setting. In this section, we elaborate on the business model design that emerged from an initial business model workshop, that focused on the design of a business model to address mobility challenges the customer was facing, which serves as input to the application of the method. For the application of the artefact, we monitored how the questions were answered and how its results were used to improve the initial business model design. We present both business model designs (i.e., before and after application), and discuss which questions triggered a change and why these questions triggered a need for change. The business models are designed by means of the SDBM/R technique and presented in Turetken et al. (2019)

5.1 Case Setting: Addressing traffic congestion in a city due to large events

The initial business model design workshop, which was held in Amsterdam, was organized to help address the significant traffic congestions that it faces during rush hours. This congestion is even further amplified when large events are held in part of the city where the event locations are clustered and consequently where large volumes of visitors at fixed intervals are attracted. As a consequence, the road infrastructure around event locations is not able to handle the influx of traffic users, leading to a significantly decreased traffic flow and strong congestion, which in turn results in increased pollution and decreased image of the city. Rather than expanding the current infrastructure or decreasing the number of events, the city sought after a collaborative, service-dominant solution to address these traffic challenges. In order to do so, the workshop brought together potential public and private stakeholders (such as the road authority and city itself, but also service providers or retailers) relevant to discuss the problem at hand and seek for a solution.

The solution that emerged from stakeholder discussions constituted of a digital platform for event visitors by car, who could, by means of their ticket, indicate which event they would visit. Consequently, the service platform, operated by a mobility broker, would present the event visitor free parking tickets in the city at selected parking providers, under the precondition that the event visitors arrive or park at the parking place at a *designated, early* time. Therefore, if the event visitors are willing to arrive early in the city, they will benefit from free parking tickets. As such, through the times set by the mobility broker (who is informed by the road authority on how the traffic is behaving), the service is able to influence when event visitors will arrive, decreasing the inflow of event visitors at peak hours.

To seek for ways to support the revenue model, retailers around event locations, and the event and event location providers were asked to contribute financially to support the service, as these actors would be able to benefit from the effects of the service as well (i.e., retailers would benefit from an increased number of event visitors that arrive early in the city, and event providers and event location providers would benefit from offering a more pleasant event experience to visitors that suffer less from congestions). The initial business model design is illustrated in Figure 4 (left).

5.2 Changes in the SD-BMD through the application of the method

The proposed method was used to evaluate this initial business model design, to which two stakeholders of the initial workshop were involved. First, the stakeholders evaluated the structural validity of the business model design through application of the questions illustrated in *Table 3*. Several directions for business model design improvement emerged. With respect to Q5 and Q7, stakeholders examined the set of value propositions and their related actor activities, and concluded that in order to implement the service, implementation support (both legal and financial) was needed. As such support could only be offered by the city itself (and not for instance solely the road authority), the city was included as an explicit actor in the model. In conjunction with Q6, this also led stakeholders to change the customer segment of the business model design. Whereas for the initial design the *event visitor by car* was selected as the customer, *the city* was selected for the improved design, as the actual need for the business model (to have few traffic jams even when multiple events are hosted) belonged to the city itself. With respect to Q7, several relatively smaller adjustments were made. For instance, an essential activity of the mobility broker is to offer free parking tickets (at proposed times) to event visitors based on their event tickets. This activity and its value proposition were not explicit for the first design.

With respect to *value capture* (specifically Q10), several changes were implemented, strongly related to the inclusion of the city as an explicit actor as part of the previous change. As the city now explicitly pays for the service implementation and to compensate part of the free ticket expenses (as a cost item listed as *subsidy*), the *mobility broker* should have an explicit benefit item that reflects this part of the exchange. Similarly, a number of exchanges between actors (for instance, spending of event visitors to event location provider, event provider and retailer) were not fully reflected by the initial SD-BMD (such that a cost item for one actor is exchanged as a benefit item to another actor). The improved business model design after evaluating its structural validity is presented in Figure 4 (right).

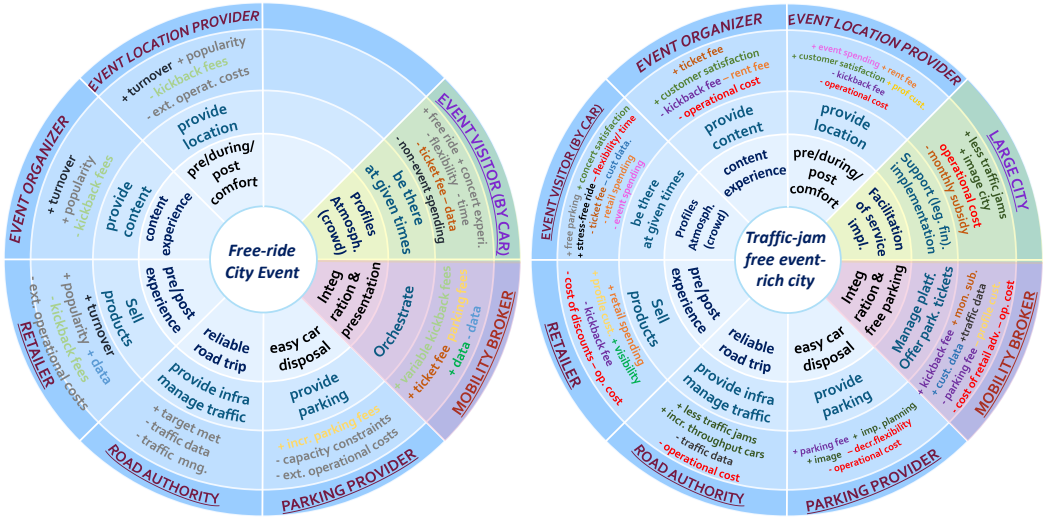

Figure 4. Business model design emergent from mobility workshop (left) and business model design after application of method (right)

The stakeholders were also asked to evaluate the remaining quality dimensions of *feasibility*, *viability* and *robustness*. With respect to the *feasibility* of the BMD, stakeholders indicated that most of the resources needed to deploy the activities were available. However, the service platform of the mobility broker was not yet available, which would have to be developed before the model can be operationalized. This was also the case for the deployment of communication and resource interfaces, but this was considered less critical. Given also that no competition was present between actors, the stakeholders considered that the initial BMD did not feature significant threats to the feasibility (characterized as *high*).

For business model *viability*, stakeholders indicated -to the best of their knowledge at this phase of the design process- that per actor the costs and benefits can be balanced. Under conditions that the service delivers the expected result (e.g., traffic reduction), for each actor initial strategic goals of participation would be reached. Under these conditions, viability of the business model was considered as *high*.

Finally, for *robustness*, the stakeholders considered that as multiple actors in the business model (such as the retailers, parking providers and event providers) represent a multitude of concrete stakeholders, a drop-out of an actor could be resolved. Only the role of mobility broker was deemed critical, as a different mobility broker would require a completely new service platform. Furthermore, as cooperation largely exists between the selected actors, contracts can relatively easily be established for service exchange, decreasing risks and uncertainty with the listed costs and benefits. Similarly, as the proposed platform constitutes a relatively simple solution, no technological or legal threats were perceived as significant. As the generic actors listed for the business model were present for most cities, the design was considered to be potentially applicable for implementation also in other cities. All in all, the robustness of the business model was regarded as *moderate* to *high*.

6 Conclusion

The digital age has offered contemporary organisations an increasingly vast amount of opportunities to improve their business activities, to which we observe that organisations increasingly adopt a service-dominant perspective to either extend their offerings or to better cater to customer needs (Ostrom *et al.*, 2015; Blaschke *et al.*, 2017). To reduce service complexity, organisations engage in service systems or networks to exchange and integrate resources towards the co-creation of value (Vargo, Maglio and Akaka, 2008; Vargo and Lusch, 2017). Accordingly, the service-dominant business model design (SD-BMD) that conceptualises how these collaborations are structured and how organisations create

and appropriate value becomes networked and complex in nature, featuring many concurrent exchanges towards the co-creation of value. As business models take a pivotal role in driving organisational performance (Casadesus-Masanell and Zhu, 2013) and bridging the gap between strategy and IT (Al-Debei and Avison, 2010), this calls for business model evaluation that is effectively able to address these concerns. However, there is a lack of approaches on business model evaluation that is explicitly geared towards addressing these concerns. In response, we have developed a method for the qualitative evaluation of service-dominant business models. The method is built on the implications of SDL for business model design and evaluation, which are translated into a set of evaluation questions. Consequently, the approach can be used to evaluate SD-BMDs through quality attributes such as structural validity, feasibility, viability, robustness (Clauß, Laudien and Daxböck, 2014; Haaker *et al.*, 2017; Schrauder *et al.*, 2018; Täuscher and Abdelkafi, 2018).

The method has important contributions to both research and practice. In addition to presenting a novel method to evaluate service-dominant business models, we contribute to research by bridging the gap between service-dominant business models (used as a representation of service ecosystems) and business model evaluation. As such, our research can be used to further support the conceptualisation and understanding of service ecosystems. To practice, our work offers a structured method that helps practitioners to qualitatively evaluate SD-BMDs and to assess design decisions in light of service-dominant business, represented in terms of evaluation quality attributes such as structural validity, feasibility, viability and robustness, especially relevant for early-phase business model design. As such, it supports decision making to continue service-dominant business model design.

This research is not without limitations. First and foremost, in light of design science research, design should also be evaluated with respect to validity and utility (Gregor and Hevner, 2013). We have illustrated the application of our artefact by means of a practical case study (*proof-of-concept*), where the stakeholders that were involved presented positive feedback on the use and clarity of the method. However, additional case instantiations in real-life industrial settings are needed to truly assess the validity and utility of the artefact. We therefore consider this paper as a steppingstone for continued work on the evaluation of service-dominant business models. Second, as explained earlier, we have derived our questions on the basis of SDL premises, and related these to quality attributes used for business model evaluation. Although we took care to generate these implications as good as possible, we cannot argue that the generated list of questions is exhaustive. However, the case study has demonstrated that the method allows stakeholders to reconsider or improve their decisions with respect to business model design and to address inconsistencies with respect to the design model, showing its initial promise.

As our proposed method is qualitative in nature and accommodates early phase business model design, future research should focus on developing quantitative methods towards service-dominant evaluation, typically catered to late phases of the business model design (McGrath, 2010; Tesch and Brillinger, 2017). Moreover, research should investigate how the link between strategy and business models can be supported. To this end, key performance indicators derived from strategy and catered to business models may be used (Wilbik *et al.*, 2020). Similarly, research should explore the interfaces between service engineering and business model engineering and to investigate how service-driven and business model-driven evaluation techniques can be combined to foster the effective design and conceptualisation of service ecosystems.

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