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Advancing Service Design Research with Design Science Research

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Abstract

Purpose: Service design is a multidisciplinary approach that is key to service innovation, as it brings new service ideas to life. In this context, the development of new service design methods and models for creating new service futures is an important stream of service design research. Such developments can benefit from a systematized research methodology that builds on existing knowledge and robustly evaluates the suitability of research contributions. To address this challenge, this article presents design science research (DSR), an established methodology from the information systems field, and examines how it can be useful for service design research by supporting the development of new artifacts, such as service design constructs, methods, and models.

Design/methodology/approach: This article shows how DSR can support service design research through a step-by-step approach. As a methodology to develop prescriptive driven solutions for classes of problems, DSR can support service design research in developing rigorous and relevant research. One illustrative example of a service design research effort using the DSR approach is presented.

Findings: Building on DSR's robust methodological background, this article discusses how DSR can support service design research, namely through the development of new methods and models, and how DSR can be adapted to leverage service design research participatory, iterative, human-centric, and creative approach.

Originality/value: This article provides an overview of DSR and proposes it as a methodology to conduct service design research, offering step-by-step guidance on the application of DSR in service design research and discussing how it can be adapted according to the specific characteristics of service design research and drive future research.

Keywords: Service Design, Service Innovation, Design Science Research, Research Methodology

Article Classification: Conceptual Paper

1. Introduction

Service design plays an increasingly important role in service research, as it brings new service ideas to life (Ostrom et al., 2010), thus enabling new forms of value co-creation with customers, organizations, and societal actors, in general (Patrício et al., 2018a). Service design can be defined as a human-centered, holistic, and iterative approach to the creation of new services (Blomkvist et al., 2010, Meroni and Sangiorgi, 2011). It integrates a service perspective through a creative and iterative process of exploration (understanding the experience of customers and other relevant actors), ideation (envisioning new service futures), prototyping (representing and testing the new services), and implementation (Patrício et al., 2019). Service design creates new service futures through a human-centered approach that allows a contextual and holistic understanding of customer experiences, aligning system actors to support customer experience and supporting

codesign and prototyping with creative tools (Yu and Sangiorgi, 2018). Overall, leveraging service design has been highlighted as a service research priority (Ostrom et al., 2010, Ostrom et al., 2015).

Service design research has focused on advancing different facets of service through a full spectrum of action-oriented research approaches, from design science focused on supporting expert decision-making and problem solving to participatory service design focused on sense-making to collectively build innovative health futures (Patrício et al., 2019). Early service design research approaches have focused on designing the frontstage and backstage of service delivery through blueprinting (Shostack, 1984). Later, service design has covered other service facets, such as service clues or the dramatic structure of events (Zomerdijk and Voss, 2010), with service interfaces playing a central role (Secomandi and Snelders, 2011). Multilevel approaches with an integrated design of service concepts, service architectures, and touchpoints have also been developed to create compelling value propositions within value networks and enhance the customer experience (Patrício et al., 2011). More recently, service design has addressed increasingly complex contexts, namely service design for value networks (Patrício et al., 2018b) and for institutional change (Wetter-Edman et al., 2018, Kurtmollaiev et al., 2018).

These diverse developments show how service design has evolved as a multidisciplinary field that builds upon service research (Shostack, 1984, Johnson et al., 2000, Goldstein et al., 2002, Cook et al., 2002, Verma et al., 2002, Bitner et al., 2008, Zomerdijk and Voss, 2009) and design (Sangiorgi, 2009, Mager and Sung, 2011, Kimbell, 2011, Secomandi and Snelders, 2011), as well as integrates contributions from the fields of marketing, operations, and interaction design, among other fields (Patrício et al., 2018a, Joly et al., forthcoming). These multidisciplinary contributions have enriched service design, but each field also brings different methodological approaches that are difficult to integrate (Patrício et al., 2018a).

Among the range of service design multidisciplinary perspectives and contributions to service research, this article looks more specifically to service design literature that focuses on developing dedicated methods for the field. Examples of such methods and tools range from service blueprinting (Bitner et al., 2008) to customer journey mapping (Følstad and Kvale, 2018), process-chain network (Sampson, 2012), and integrated approaches for designing technology-enabled services (Teixeira et al., 2017). These methods and tools are grounded on extensive applications to real-world situations. However, the development of service design methods still lacks a well-established systematized research methodology that can help service design researchers better ground their contributions on existing knowledge and more robustly evaluate the suitability of these contributions to address service challenges. The lack of such a methodology has led to calls to reinforce the foundations of service design research by exploring multiple research methods (Patrício et al., 2018a, Ostrom et al., 2015).

To address these calls, this article presents design science research (DSR), a domain-independent research strategy (Van Aken et al., 2016) that was initially developed in Information Systems (IS) (March and Smith, 1995, Hevner et al., 2004, Peffers et al., 2007, Walls et al., 1992, Nunamaker et al., 1990) and is spreading to service research (Beloglazov et al., 2015, Teixeira et al., 2017, Patrício et al., 2018b), operations management (Van Aken et al., 2016), and design (Costa et al., 2018). DSR focuses on understanding organizational phenomena in context and on advancing research by creating and evaluating dual-purpose artifacts that 1) solve organizational, real-world problems and 2) advance a field's knowledge base, i.e., offer a research contribution (Hevner et al., 2004, Gregor and Hevner, 2013).

DSR artifacts are constructs, models, methods, and instantiations (i.e., applications of artifacts) that are innovative and valuable in such a way that they offer a research contribution

(March and Smith, 1995, Hevner et al., 2004). Constructs are the vocabulary to define problems and solutions; models are representations of the problem; methods define processes; and instantiations are applications showing that the artifacts can be implemented and can solve the identified problem (Hevner et al., 2004). For example, Secomandi and Snelders (2011) research on the conceptualization of service interfaces in service design can be considered a development in service design constructs. On the other hand, Shostack (1984) service blueprinting and Teixeira et al. (2017) MINDS method involve the development of both service design methods and tools.

DSR is supported by a robust and growing literature that offers researchers a comprehensive understanding of the methodology (Hevner, 2007, Peffers et al., 2007, Hevner et al., 2004, Baskerville et al., 2018) and guides them to positioning and presenting contributions (Gregor and Hevner, 2013, Gregor and Jones, 2007, Peffers et al., 2018a) and to evaluating them (Peffers et al., 2012, Venable et al., 2012). Therefore, DSR can support service design research efforts by providing a robust and well-documented methodology that aims to rigorously develop and evaluate service design research contributions and address real-world problems. To this end, this article details the process for conducting DSR from a service design perspective, highlighting the most relevant aspects for conducting service design research using DSR. Supporting literature for each step of the process is presented, as well as an illustration of how DSR has been applied in service design research (Patrício et al., 2018b). The next section introduces the theoretical underpinnings of service design research and DSR, followed by a description of the DSR process and its application to service design research. The article concludes by discussing how DSR's main concepts and positioning can be interpreted from a service design perspective and offering future research direction to leverage and evolve DSR for service design research.

2. Service Design Research and DSR

Service design is an evolving field, and although it is frequently considered as originating from and as a subfield of design, the initial contributions to service design can be traced to Shostack (1984) seminal article on service blueprinting. Recently, service design multidisciplinary contributions have been traced to service research, design, IS, interaction design, and operations management (Joly et al., forthcoming). According to this study, a service perspective provides the conceptual framework to design for value co-creation within service systems (Edvardsson and Tronvoll, 2013), whereas design offers the methods and tools to support the process of understanding and envisioning new forms of value co-creation through service (Kimbell, 2011). Marketing brings an extensive understanding of customer-centric service systems (Mahr et al., 2013) at both frontstage and backstage of service provision (Bitner et al., 2008). The design of service interfaces to support the user experience is a key contribution of interaction design (Zimmerman et al., 2011). Operations management, in turn, focuses on planning and controlling service operations and on designing the entire service delivery system to enable the customer experience (Sampson, 2012). In parallel, IS contributes with the information technology (IT) component of service systems (Glushko and Nomorosa, 2012). With such rich multidisciplinary contributions, it is not surprising that service design research assumes many forms and its methodological foundations need further exploration (Patrício et al., 2018a, Ostrom et al., 2015).

Service design research is rooted in design research (Patrício et al., 2018a). Similar to service design, design research is approached from different disciplinary backgrounds, such as the fields of design (Buchanan, 2001, Archer, 1981), art (Frayling, 1993), management (Pandza and Thorpe, 2010, Kasanen et al., 1993, Van Aken, 2004), interaction design (Fallman, 2008, Forlizzi et al., 2008), and IS (March and Smith, 1995). DSR is rooted in Herbert Simon (1969) who, in *The*

Sciences of the Artificial, describes design as "how things ought to be, with devising artifacts to attain goals" and the designer as one "who devises courses of action aimed at changing existing situations into preferred ones." However, design researchers often focus on solving specific problems without developing theories or abstracting knowledge (Buchanan, 2001, Friedman, 2003, Van Aken, 2004). Friedman (2003) further adds that there is confusion between research and practice, leading to the positioning of tacit knowledge from design practice as a research contribution. DSR can contribute to overcoming this challenge by focusing on rigorously developing prescriptive-driven solutions for classes of problems, i.e., on developing abstract knowledge that contributes to a field's knowledge base, rather than a situated solution for a specific problem (Van Aken, 2004, Hevner et al., 2004). In the IS literature, the artifact has been considered to be an IT one (Baskerville et al., 2018). These artifacts have been depicted as constructs, models, methods, and instantiations that are related to the design of IT systems or software (March and Smith, 1995, March and Storey, 2008). However, Peffers et al. (2018b) recognize the cross-disciplinary nature of DSR and argue that there are different genres of DSR that use and adapt this methodology according to each field's characteristics.

Service design research has dedicated considerable attention to the development of artifacts, such as new models and methods (Blomkvist et al., 2010). In fact, this research stream can be highlighted because of the number and impact of published research articles in peer-reviewed journals (Chai et al., 2005, Bitner et al., 2008, Patrício et al., 2011, Sampson, 2012, Sousa et al., 2016, Teixeira et al., 2017, Patrício et al., 2018b). While these efforts have not, until recently, used a DSR approach, Teixeira et al. (2017) and Patrício et al. (2018b) introduce DSR to develop methods to design, respectively, technology-enabled services and services that support complex many-to-many interactions.

These articles show that DSR can support service design research to rigorously develop methods and models that are relevant to service design research and to real-world challenges addressed by service design. Building on the extensive literature about the process of conducting DSR, the next section presents a DSR approach to conduct service design research, and illustrates how it can be applied to service design research.

3. Applying the DSR Methodology to Service Design Research

Many different approaches to conduct DSR have been proposed in the literature, such as in the pioneering works by Nunamaker et al. (1990) and Walls et al. (1992). Hevner et al.' s (2004) seminal article offers a set of guidelines to conduct DSR, and this is later extended and arranged into a three-cycles view, encompassing relevance, design, and rigor (Hevner, 2007). The relevance cycle bridges the research contextual and empirical ground, i.e., the organizational or societal problems addressed by the research with the design of the artifact. The design cycle involves building, designing, and evaluating the artifact. Finally, the rigor cycle relates the design of the artifact with existing and relevant scientific and methodological foundations. Offering a structured and step-by-step approach, Peffers et al. (2007) propose the design science research methodology (DSRM). DSRM is well suited for cross-disciplinary research and has already been applied in service design research (Teixeira et al., 2017, Patrício et al., 2018b).

Building on DSRM and the three-cycle view, Figure 1 presents a DSR process for service design research. In this DSR process, the stages proposed by Peffers et al. (2007) were combined for improved clarity. Furthermore, Figure 1 shows how DSR builds on empirical grounds (the real world) for relevance, and combines it with the service design knowledge base for rigor. Following the overall structure of the DSRM, the process starts with the identification of the research problem(s) and the motivation for the research. Basing on evidence, reasoning, and inference, the

DSR process continues toward defining the objectives of a solution in order to solve the research problem. This DSR process should be based on prior knowledge in the given field of research. This knowledge is then used to design and develop an artifact and to create *how-to* knowledge. Following that, the artifact is used to solve the pre-described problem. Thus, it is applied in a suitable context before its effectiveness and/or efficiency is evaluated. This approach leads to disciplinary knowledge, which is then communicated to both academia and practice.

(Insert Figure 1 around here)

To illustrate how DSR can offer a valuable research approach for the development of new service design artifacts, more specifically service design methods and models, this article illustrates each phase in reference to Patrício et al. (2018b) research, which involves the development of a new service design method, the Service Design for Value Networks (SD4VN). SD4VN is a method to design services in complex networks as an enabler of many-to-many value co-creating interactions. These services require a balanced approach to address the multiple and often conflicting goals of numerous stakeholders. DSR was considered useful in developing the SD4VN method because it is a well-documented methodology with step-by-step guidance and evaluation criteria; it has been considered useful and relevant to service research and service design (Patrício et al., 2018b, Ostrom et al., 2015).

3.1. Identifying the class of problems and the solution objectives

This first phase involves defining the research problem and motivating for the importance of developing a solution that addresses the problem. This requires an understanding of the state of

the problem and the importance of a solution (Peffers et al., 2007). The objectives of a DSR solution can be defined quantitatively by establishing how much the desired solution should be better than the current one, or qualitatively by describing how the new artifact should better support the identified problem (Peffers et al., 2007). The definition of the objective also has significant repercussions in the later stage of evaluation because it will frame how the evaluation is conducted. As such, when defining the objectives of a solution, service design researchers using DSR should also prepare an adequate evaluation method.

As shown in Figure 1, service design research deals with a broad range of relevant real-world challenges concerning technology-enabled (Teixeira et al., 2017, Kurtmollaiev et al., 2018), experience-centric (Zomerdijk and Voss, 2009), financial and retail (Patrício et al., 2011), healthcare (Patrício et al., 2018b), or non-profit (Baron et al., 2018, Trischler et al., 2018) services. However, not all problems addressed by service design constitute a research problem and thus require a DSRM approach. A routine design problem, in which knowledge to address a problem area already exists, is the domain of service design practice (Gregor and Hevner, 2013). Therefore, the problem identified in this first stage must be relevant to the service design empirical domain, meaning it addresses important service design-related challenges, and to research, meaning it addresses a class of problems and adds to the service design knowledge base (Hevner et al., 2004, Hevner, 2007, Van Aken, 2004). In service design research, the knowledge base is very significant, as it includes service design existing principles and concepts (Yu and Sangiorgi, 2018, Secomandi and Snelders, 2011, Goldstein et al., 2002), models and methods (Bitner et al., 2008, Tax et al., 2013, Patrício et al., 2018b, Teixeira et al., 2017), and a rich set of multidisciplinary contributions (Joly et al., forthcoming).

In the SD4VN example, the identified research problem concerned the dyadic approach (customer–service provider) of available service design methods, meaning there was a lack of service design methods that incorporated a value network perspective and that could deal with its related complexity (interactions among multiple actors). This problem was also relevant to several real-world contexts, as increasingly complex service systems are required to co-create critical services, such as healthcare. Henceforth, the objective of the solution for this class of problems was to develop a service design method for designing services that enable value co-creating interactions in value networks. However, because of the multiplicity of actors in a value network, the designed solution should also pursue balanced centricity. Balanced centricity means that in a value network, the designed service should not focus on the goals of one customer but should support the different actors of the network in reaching their goals in a balanced way (Gummesson, 2008). Following a DSR approach, SD4VN contributed to a relevant problem in healthcare and was grounded on relevant service research literature on value networks and service systems.

3.2. Designing and developing a solution to a class of problems

DSR involves the design and development of an artifact that addresses the identified problem and accomplishes the defined objectives (Hevner et al., 2004). Artifacts are well suited to service design research, as service design has a strong tradition of using visual models both in research and in practice (Blomkvist and Segelström, 2014, Diana et al., 2012, Blomkvist et al., 2010), as well as lacks dedicated models and methods (Ostrom et al., 2010, Patrício et al., 2018a). Service design builds on a broad range of multidisciplinary contributions from fields, such as service research, design, service marketing, operations management, interaction design, and IS (Joly et al.,

forthcoming). These multidisciplinary contributions also bring a rich set of knowledge that can be built upon.

Regarding the design and development stage, the artifact developed by Patrício et al. (2018b), SD4VN, was a new method. SD4VN involves (1) mapping the value network to identify key actors and their relationships, (2) understanding the experience of each actor in the network and mapping their interconnections, and (3) designing the value network service concept. The development of this new method and respective models was grounded on concepts, such as value networks and value co-creation, which stem from service research (Vargo and Lusch, 2008, Gronröos, 2008), as well as balanced centricity, which originates from service marketing (Gummesson, 2008). SD4VN also combines and adapts several service design models to the value network context (Morelli and Tollestrup, 2007, Patrício et al., 2011, Teixeira et al., 2012). SD4VN was a new solution for an identified problem, thus contributing to an improvement (Gregor and Hevner, 2013) over previous research that had a dyadic focus.

3.3. Applying the artifact and evaluating

The application of the artifact involves using it to solve one or more instances of the problem by resorting to experimentation, simulation, case studies, or other suitable methods (Peffers et al., 2007). The application, or instantiation, of the artifact demonstrates the feasibility of the design process and the design outcome (Hevner et al., 2004). As such, the demonstration and the evaluation stages can also be considered as one (Nunamaker et al., 1990). Evaluation is considered a crucial stage of DSR (Hevner et al., 2004, Peffers et al., 2007). However, while there is a consensus that evaluation is essential, the way to perform it is sometimes more elusive (Peffers et al., 2012, Peffers et al., 2018a). Evaluation is often considered in quantitative terms as a way to

guarantee rigor, but it is not always necessary or even recommended if it entails an excessive formalism that can only decrease the relevance of the contribution (Hevner et al., 2004). As such, DSR evaluation is closely connected with the designed artifact and should be adapted to the types of artifacts developed. Venable et al. (2016) suggest a four-step approach to structure the DSR evaluation process starting with (1) explicating the goals of the evaluation, (2) choosing the evaluation strategy, (3) determining the properties to evaluate, and (4) designing the individual evaluation episodes. To evaluate its artifacts, DSR can resort to several methods, both quantitative and qualitative, such as expert evaluations, technical experiments, action research, prototypes, case study, or illustrative scenarios (Peffers et al., 2012).

Service design research frequently resorts to qualitative methods, such as ethnography (Atkinson and Hammersley, 1994) and case research (Blomkvist et al., 2010, Yin, 2017, Voss et al., 2002, Eisenhardt, 1989), or quantitative methods, such as survey research (Fowler Jr, 2013). However, the focus should not be the specific case involved but the development of a generalizable artifact that addresses a class of problems. Service design research using DSR therefore approaches the case study instrumentally to apply the artifact in a real-world context and assess its ability to address the identified problem. This application should be conducted rigorously, following the required methodological procedures, as rigor is a fundamental principle of DSR (Hevner et al., 2004). Therefore, the application of a service design artifact requires an iterative dialogue between DSR (creation of new artifacts) and social science (exploration and evaluation) (Patrício et al., 2018b). Service design research that is focused on developing new models and methods has engaged in the qualitative evaluation of the developed artifacts, resorting to interviews and focus groups to evaluate their demonstrations (Patrício et al., 2018b, Teixeira et al., 2017). The DSR evaluation stage has also been used to assess service design research efforts that use other

approaches (Costa et al., 2018). On the relevance side, the application of a service design artifact can then lead to the development of new service concepts, service prototypes, and the implementation of new services.

In the study of Patrício et al. (2018b), the SD4VN method was used to develop a national electronic health record (EHR), a service to securely share patient data in digital form (Hayrinena et al., 2008) between a complex value network of interdependent actors (e.g., citizens, doctors and nurses). The application of the SD4VN method to develop the EHR involved a qualitative approach (Corbin and Strauss, 2008), in which focus groups, in-depth interviews, and participatory design sessions (Sanders, 2008) were conducted with over 170 participants throughout the different stages of the SD4VN method (mapping the value network, understanding the multiple actors' experiences and interactions, and designing the value network service concept and service architecture).

The evaluation of SD4VN was threefold. First, the impact of the EHR designed using SD4VN was analyzed. The EHR had a very significant impact on the respective national health systems; in 2018, more than 1.8 million citizens (from a total population of 10.2 million) and 650 institutions were registered, with an average daily access of 100,000 healthcare practitioners and over 12,000 citizens. As healthcare professionals and citizens are not obliged to register or use the EHR, these usage numbers indicate a good response by all stakeholders. Adding to this analysis, a qualitative study involving 37 healthcare professionals was performed to assess the usefulness of the EHR for their work. This study concluded that the EHR was very well regarded by healthcare staff, being considered a significant improvement over other available healthcare IS. Second, the process of developing the EHR, i.e., the SD4VN method, was evaluated by the software development team through regular meetings. The development team highlighted that the network

perspective of SD4VN was especially useful in a complex setting, such as healthcare. Finally, following Forlizzi et al. (2008), SD4VN was evaluated according to the criteria for design research contributions, namely process, invention, relevance, and extensibility. As such, SD4VN was comprehensively evaluated by resorting to several DSR evaluation methods, such as case study and expert evaluations. The SD4VN case shows how service design research can strengthen the rigor of its contributions without decreasing its relevance by using suitable DSR evaluation methods.

3.4. Communicating

Aligned with the quest for relevance to real-world problems, as well as for research rigor, a DSR approach involves communicating the results to scholarly and practitioner audiences. Communication to these audiences aims to ensure that the contribution of DSR is added to the knowledge base (Hevner, 2007). Communication should also include the application context to ensure that the solution to the real-world problem reaches those who experience it. While DSR is already a mature methodology in the IS field, a recognizable and broadly accepted structure to present DSR has yet to be consolidated. To systematize the communication of DSR in research outlets, Gregor and Hevner (2013) propose a publication schema with the following sections: introduction (problem and objective definition), literature review (existing knowledge base that grounds the artifact development), method (DSR work), artifact description (showing how it contributes to the knowledge base), evaluation (showing how the worth of the artifact was assessed), discussion, and conclusion.

The multidisciplinary background of service design research brings many potential research outlets to communicate the results of DSR work. However, as each of the service design

contributing fields has its own research traditions and might be relatively unaware of DSR, an approach similar to that described by Gregor and Hevner (2013) is especially useful.

Regarding communication, SD4VN has been disseminated to both practitioner and academic audiences. Regarding practitioner audiences, while SD4VN has not been published in practitioner-oriented outlets, it was used in multiple workshops with stakeholders, both for the development of the EHR and in dedicated training sessions for health information systems professionals, thus disseminating the method itself. Regarding academic communication, the SD4VN method was published in research journals from different fields, focusing on both the method and the EHR instantiation (Patrício et al., 2018b, Patrício et al., 2019, Grenha Teixeira et al., 2019).

Having explained the different stages of the DSR process and how DSR can be applied to service design research, the next section discusses how DSR can further foster service design research and vice versa.

4. Implications and Future Research

Service design research has already successfully applied DSR to develop new service design methods. However, advancing service design as a human-centered, participatory, and multidisciplinary approach to creating new services can benefit from dedicated DSR approaches for service design. This cross-fertilization between DSR and service design has several implications and opens new and promising avenues for research.

Table 1 summarizes the implications of using DSR for service design research, particularly addressing 1) how artifacts can be viewed in light of service design research, 2) how DSR

processes, such as DSRM, can be adapted to better fit service design research, and 3) how service design research contributions developed with DSR can be positioned.

(Insert Table 1 around here)

First, as depicted in this paper, a focal concept of DSR is the artifact. DSR describes artifacts as constructs, models, methods, and instantiations, (March and Smith 1995; March and Storey 2008). DSR artifacts can be associated with IT systems or software (Baskerville et al., 2018). However, authors, such as Peffers et al. (2007), take a more social science approach, talking of methods for understanding user needs for an IS. Other authors have extended the use of artifacts to business models (Osterwalder and Pigneur, 2012). As such, the use of the artifact goes well beyond IT systems, and the term should be contextualized to the field of research in question.

Service design methods can be considered as artifacts when applying DSR to service design research, which is well aligned with extant DSR literature. However, other types of artifacts can also be explored by service design. For example, service design models, such as service blueprints (Shostack, 1984, Bitner et al., 2008), can be developed using DSR.

Perhaps more importantly, the characteristics of service design artifacts are different from those of IS artifacts. While IT artifacts in the IS literature are related to IS or software, service design artifacts are service centered. This means that service design involves an understanding of the needs of different service system actors to design new service solutions that meet such needs (Lin et al., 2011). Therefore, artifacts developed when applying DSR in service design research are based on an understanding of different actors' experience, and/or include participation from relevant actors of the service system in the design decisions. For example, the SD4VN method

includes a qualitative study to map different service system actors experience and interactions, and involves the active participation of relevant actors in the design process as a part of the method itself.

Second, the DSR process has been systematized by several authors. For example, Peffers et al. (2007) offer a clear path to presenting the development of artifacts and their relevance for research and practice. The adaption of Peffers et al. (2007) and Hevner (2007) processes for service design research (Figure 1) highlights the interaction between the service design knowledge base and empirical grounds and includes the following four main phases: 1) problem identification and definition of a solution objective, 2) the design of the artifact (solution), 3) the application of the solution in the real world and evaluation, and 4) communication of the findings. This DSR process for service design research is aligned with the iterative, participatory, and human-centered nature of service design (Patrício et al., 2018a, Sangiorgi, 2010). Iterations are suggested by several DSR methodologies (Peffers et al., 2007, Hevner, 2007), and a DSR process for service design research can include them at different stages. First, several rounds of data collection can be performed to improve the understanding of the actors' experience. Second, prototypes can iteratively test new service solutions with their intended audience. In addition, service design often uses a participatory approach, in which the expertise of customers, users, and/or employees is leveraged by integrating it in the design process (Sangiorgi, 2010). This participatory approach is relevant and a DSR approach for service design research should involve relevant actors in the design process.

Third, service design research can develop several types of contributions by using a DSR approach. The nature of research contributions has been a topic of debate for DSR studies, with Gregor and Hevner (2013) proposing three types of research contributions: (1) adapting and extending solutions from one field to another, (2) developing better solutions for known problems,

and (3) creating new solutions for newly identified problems. First, as a multidisciplinary field, service design is a fertile ground for extending solutions from one field to another, such as applying DSR to adapt existing service design methods and models to contexts that have not been explored. For example, this could involve following a DSR approach to expand service design in general or apply a method such as the Multilevel Service Design (Patrício et al., 2011), to other research areas such as sports management or marketing (Kallitsari and Theodorakis, 2018). Second, service design research has already used DSR to develop better solutions for identified problems, namely by developing service design methods for complex value networks, as well as to design technology-enabled services (Patrício et al., 2018b, Teixeira et al., 2017). Finally, service design research can also leverage the creative nature of service design to create entirely new solutions for new problems.

Leveraging DSR as research methodology for service design also offers a rich set of research opportunities, as illustrated in Figure 2. This research potential can be structured in three main areas: expanding service design research real-world impact; evolving DSR for service design research; and expanding service design research knowledge base.

(Insert Figure 2 around here)

First, DSR can help service design research to expand its real-world impact. By being focused on solving real-world challenges, DSR is well-suited to support service design in engaging in transformative service research (Anderson et al., 2013) and contributing to societal well-being. Perhaps more importantly, by focusing on solving classes of problems, and not single instances, DSR can help service design research in developing generalizable knowledge that can have a

greater and transformational change, truly broadening service design research impact in the real-world. DSR can also contribute to expanding service design research in the real-world by addressing the challenges brought by ever-changing technology. As artificial intelligence, service robots and the internet of things have increased relevance for service (Huang and Rust, 2018, Ng and Wakenshaw, 2017, Wirtz et al., 2018, Čaić et al., 2018), DSR can help service design research to develop new models, methods and theories to understand and design value co-creating services with these technologies. Finally, service design has a rich and active practitioner community that can be engaged to pursue research endeavors by using DSR well-defined, step-by-step approach. With its unique blend of solving real-world problems and offering research contribution DSR can be presented to the practitioner community as a way to support their work, while building a more robust and generalizable knowledge base that can further enrich research and practice.

Second, service design researchers can focus on evolving DSR for service design research by adapting existing DSR methodologies to their research contexts, as well as combining DSR with other research approaches. For example, Costa et al. (2018) combined a design research approach coming from design with the evaluation phase of DSR to develop new methods for integrating product–service system and service design. Also, the applicability and adaptation to service design research of other DSR methodologies can be considered, such as design-oriented IS research (Kuechler and Vaishnavi, 2008) or action design research (Sein et al., 2011). Finally, other adaptations can involve the specific aspects of the DSR process, namely, by developing evaluation techniques for service design research contributions developed with DSR. This might include integrating other contributions from fields associated with service design, such as Forlizzi et al. (2008) criteria for evaluating design research contributions already used in SD4VN; the development of adapted evaluation processes, such as in the work of Venable et al. (2016); or the

integration of DSR with design research approaches coming from a design background (Costa et al., 2018). This way, more than using the current DSR literature, service design research should develop its own genre of DSR, one that leverages service design literature's rich background, creativity, and, most importantly, service-centricity.

Finally, DSR can help expand service design research knowledge base. First, by building upon DSR systematic approach and IS origins, service design research can expand its knowledge base by bridging with more technical-oriented and engineering-related fields. Using DSR as a common ground with, for example, software engineering, new interdisciplinary service design methods can be developed to address emerging challenges brought by technologies such as artificial intelligence, service robots or the internet of things. DSR roots on design research can also further strengthen the link between service design research and design studies (Fallman, 2008).

5. Conclusion

DSR is a well-known and documented methodology in IS but despite being used increasingly in service design and service research, it is still new to many scholars in these fields. This article makes a first attempt at introducing DSR literature, terminology, and processes, including potential contributions and respective evaluations, to service design researchers. This article also presents an application of DSR, showing how it can be used to support service design research. Finally, this article presents how future research can leverage DSR to expand service design research impact on the real-world, expand service design research knowledge base, and evolve DSR for service design research. These research directions also address recent calls for future research in service design and innovation Patrício et al. (2018a) namely: expanding the foundations of service design

by integrating multiple perspectives and methods, advancing service design by leveraging the role of technology; and strengthen research impact through transformative service research.

DSR was already successfully used to conduct service design research (Patrício et al., 2018b, Teixeira et al., 2017). However, these are still early-efforts to leverage this methodology and use it so that service design research can offer relevant real-world contributions, while solving classes of problems that offer rigorous research contributions. By showcasing DSR, how it can be applied to service design research and suggesting future research directions, this article is enriching service design research toolset and hopefully setting the groundwork for establising DSR as a cornerstone methodology for service design research.

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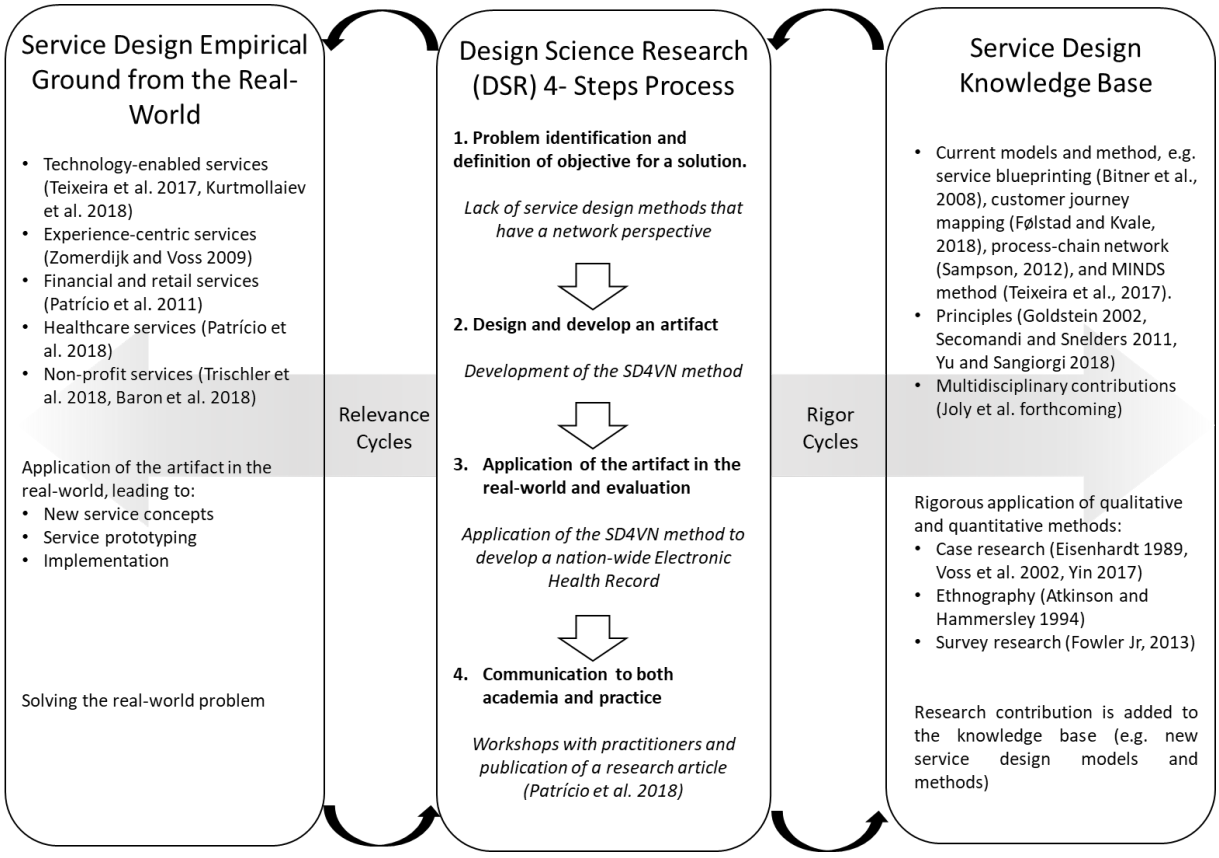

Figure 1 – DSR for Service Design.

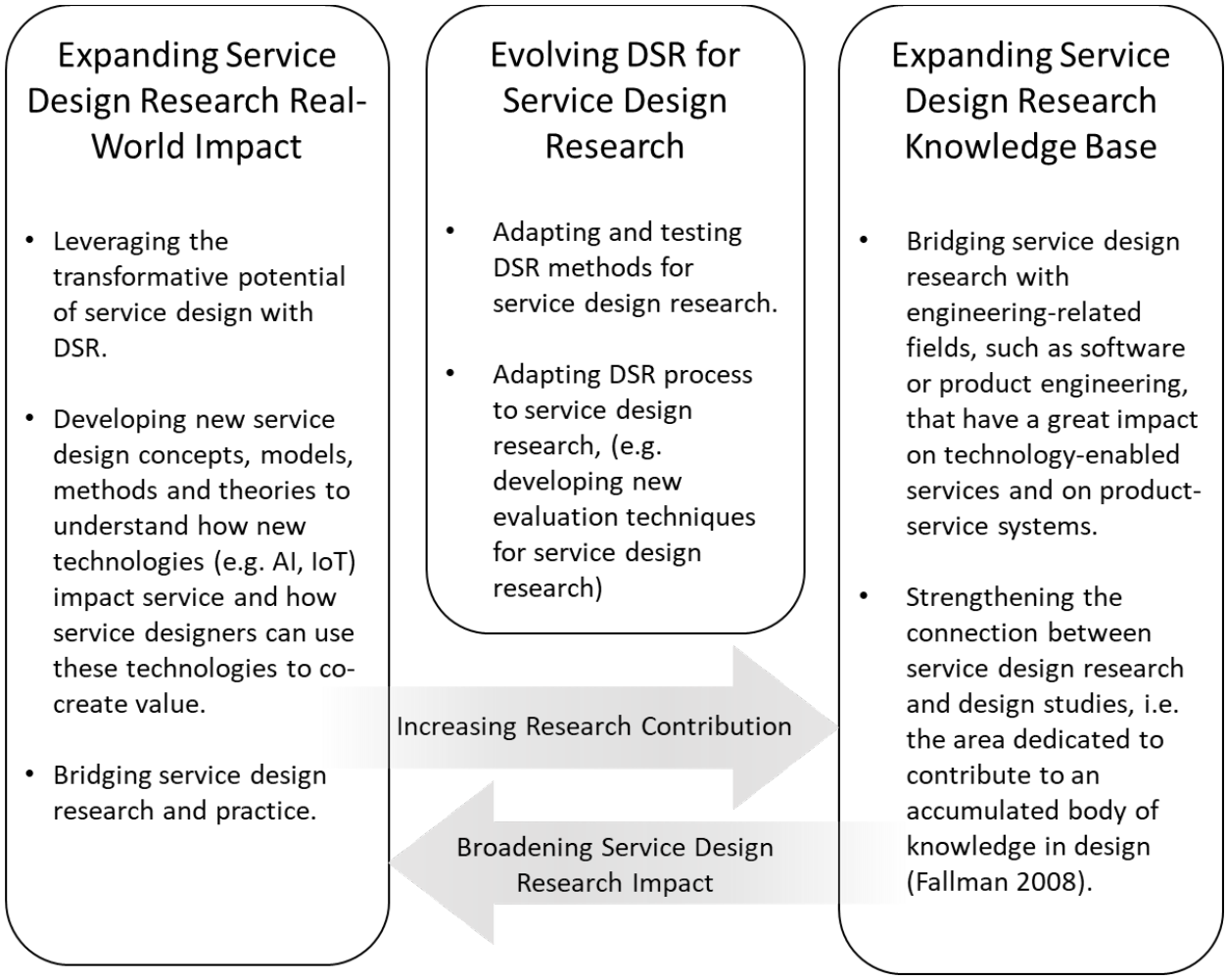

Figure 2 - Future Research directions for service design research with DSR.

Table 1 – Implications of using DSR in Service Design Research

	DSR in Service Design Research
Nature of the Artifact	Earlier applications to service design research have shown that DSR is particularly suitable for the development of artifacts, such as new service design methods and models. Through DSR, service design approaches have evolved to address new challenges, such as leveraging technology to develop value co-creating service solutions, network services, or product-service systems. As service design addresses constantly emerging technology and increasingly complex contexts, the usage of DSR can support the development of new kinds of artifacts such as new service design concepts and theories.
DSR Process	Conducting service design research through DSR should consider the human-centered, iterative, participatory nature of service design. As such, it is expected that the DSR process in service design research is iterative by engaging in several rounds of data collection to improve the understanding of the actor's experience, as well as by prototyping and testing new service solutions with the intended audience. Moreover, a DSR process in service design research is expected to be human- centered by understanding multiple actors' experiences and participatory by involving customers, users, and/or employees in the design process.
Contributions	Service design research can make several potential contributions by using a DSR approach, including (1) building on the multidisciplinary nature of service design to adapt and extend solutions from one field to another, (2)

	developing better solutions for known problems, and (3) creating new solutions for newly identified problems.