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PATHS TOWARDS RADICAL SERVICE INNOVATION IN MANUFACTURING COMPANIES - A SERVICE-DOMINANT LOGIC PERSPECTIVE

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BIOGRAPHICAL NOTES

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ABSTRACT

Research on servitisation of manufacturing companies concentrates on typologies of product-service bundles, on transition pathways to increased servitisation, and on resource and capabilities configurations necessary to accomplish this transition. Missing from existing research is an analysis of the degree of novelty of service innovations introduced by manufacturing companies. Therefore, this article shifts the focus from the transition process itself to the question of how manufacturing companies can introduce radical service innovations to the market. This article links servitisation literature with service innovation literature and investigate how manufacturing companies can introduce radically new services in terms of three forms of innovations: Service Concept Innovations, Customer Experience Innovations, and Service Process Innovations. Service-Dominant Logic (SDL) is applied as the theoretical lens because it covers four significant factors influencing the success of companies' innovation activities: actor value networks, resource liquefaction, resource density, and resource integration. Based on a multiple case study of 24 Danish business-to-business manufacturing small and medium-sized enterprises and through a fuzzy set Qualitative Comparative Analysis, different configurations of the principles of SDL are analysed. They describe the paths to radical service innovation. Digitalisation appears as a central causal condition in the bulk of the configurations. Big and rich data generated internally within the focal company in combination with for instance customer data can enhance the innovativeness of the service offerings. However, digitalisation is not a sufficient condition for launching radical service innovation – it should be combined with an efficient mobilisation of resources internally within the focal company and/or collaboration with other organisations within the value system. In addition, the analysis hints to a need to detach from immediate customers as the prime driver of service innovation.

KEYWORDS

Service-Dominant Logic (SDL), radical service innovation, servitisation, fuzzy set Qualitative Comparative Analysis (fsQCA), digitalization, value network, customer integration,

PRACTIONER POINTS

- Digitalisation plays an essential role for the introduction of radical service innovation. However, converting digitalisation into value through service innovation represents a substantial managerial challenge for manufacturing B2B SMEs
- Introduction of radical service innovation often requires collaboration within the value network and a key task of managers of manufacturing B2B SMEs is to identify expedient partners for developing the service innovations
- Customers should play a role in radical service innovation. Manufacturing B2B SMEs should, however, not be over-reliant on the preferences of their immediate customers because a keen focus on these preferences might jeopardise the radicalness of the service innovation.

INTRODUCTION

Researchers and practitioners have for several decades focused increasingly on new service development. The relevance of new services is empirically reflected in the high shares of services calculated by OECD (2018) for post-modern societies, which in most OECD countries exceed 60% of economic value added and shows an increasing trend. However, scholarly literature on service innovation covers widely diverse aspects and Biemans, Griffin and Moenaert (2016) state that, despite growing popularity, the resulting body of research "fails to provide managers with consistent answers to basic questions about how to most effectively manage NSD [new service development] processes" (p. 382). It is difficult to generalise about new service development because services are very heterogeneous and dependent on contingent factors (Kuester et al., 2013). The growing servitisation ambitions of manufacturing companies amplify this heterogeneity. Academic publications reflect this trend with an increase of articles focusing on various efforts of manufacturing companies to introduce services to their customers by combining products and services (Carlborg, Kindstrom and Kowalkowski, 2014). So far, research on servitisation of manufacturing companies has highlighted the pathways towards servitisation and the role of new capabilities needed for this transition (Brax and Visintin, 2017, Ulaga and Loveland, 2014). Furthermore there are studies about the impact of servitisation on business models, as well as the benefits from servitisation for long-term relationships with customers (Antioco et al., 2008), customers' willingness to pay for product-linked services (Benedettini, Swink and Neely, 2017) and customer satisfaction (Gebauer et al., 2010).

An area that has been overlooked so far in this research stream is the degree of novelty or newness of servitised offers. Prior literature on servitisation does not distinguish between incremental and radically new services introduced by manufacturing companies. Therefore, this article focuses on

the ability of manufacturing companies to *introduce radical service innovations to the market*. The distinction between incremental and radical innovation is well established in the innovation management literature. While incremental innovations build on existing knowledge, radical innovations build up new knowledge or recombine existing with new knowledge (Hill and Rothaermel, 2003). Radical innovations are relevant for companies because they involve the opportunity of creating market disequilibria (Utterback and Abernathy, 1975) allowing companies to gain competitive advantage over a longer period of time. This study responds to recent calls for understanding which resources are needed for radical service innovation (Snyder et al., 2016). Accordingly, the research question guiding this article is:

"What different paths do manufacturing companies follow to launch radical service innovations?"

To investigate the research question, Service-Dominant Logic (SDL) is applied as the theoretical lens. SDL is particularly suitable for an analysis to explain how manufacturing companies are able to introduce significant (radical) service innovations on the market, because SDL incorporates four factors that researchers consider to be significant for influencing the innovation activities nowadays: the *actor value network*, which in SDL considers the importance of value creation in a network that goes beyond the boundaries of the company (Chesbrough, 2011); *resource liquefaction*, which in SDL is related to the major shifts and opportunities driven by digitalisation (Troilo, De Luca and Guenzi, 2017); *resource density*, which in SDL is the requirement that companies activate and combine necessary resources most effectively and efficiently in order to provide value to the market (Lusch, Vargo and Tanniru, 2010); and, *resource integration*, which in SDL is the factor describing integration of the customer as a resource in value co-creation (Melton and Hartline, 2015, Perks, Gruber and Edvardsson, 2012). Methodologically, this research responds to recent calls for in-depth analysis to present a more fine-grained understanding of service innovation (Biemans, Griffin and

Moenaert, 2016). The empirical study is based on data from 24 manufacturing business-to-business Small and Medium-Sized Enterprises (SMEs) that have introduced new services to the market. Fuzzy set Qualitative Comparative Analysis (fSQCA) is used to analyse the qualitative data (60 interviews, observations and secondary data) to detect the paths that lead to the introduction of radically new services.

This article contributes to existing literature in the following ways: a) the link between servitisation literature and service innovation literature is established; b) if offers insights how different combinations of four main factors (axioms) of SDL lead to the introduction of radical service innovations of manufacturing companies; and c) the central role of digitalisation and actor value networks for the creation of radical service innovations is further illuminated.

The remainder of the manuscript is organised as follows: first an overview of existing servitisation and service innovation research is provided. Next, SDL is introduced as the theoretical lens for this study, the four main axioms of SDL are explained, and the research model that integrates these axioms is presented. Then the empirical study is presented together with the identified configurations of causal conditions for manufacturing companies that successfully introduced radically new services (i.e., they achieve Service Concept Innovation, Customer Experience Innovation, and/or Service Process Innovation). The results highlight a central role of resource integration is not found to be an essential factor. The last part of the article discusses these findings in detail.

THEORETICAL FRAMEWORK

Research on servitisation of manufacturing companies

Prior research on the service transition of manufacturing companies offer various understandings of servitisation (see for a comprehensive overview of this research area Rabetino et al., 2018). Early publications focus on typology identification of companies offering different product-service bundles. For example, Antioco, et al. (2008) introduce distinctions between companies that offer services in the support of the product (i.e., services delivered to support the installation and use of a tangible product) as opposed to services delivered in support of the client's actions (i.e., where services are themselves perceived as products and may be experienced without buying a tangible product). An influential typology by (Ulaga and Reinartz, 2011), proposes four types of hybrid offerings, with each requiring different resources by the focal company.

Subsequent publications focus on transition paths that lead manufacturing companies towards becoming service providers. A substantial number of publications recognise different types or maturity levels of transition stages. For example, Kowalkowski et al. (2015) identify three growth trajectories through servitisation. Similarly, Cusumano, Kahl and Suarez (2015) present a 'smoothing, adapting, substituting' distinction of product-related services and analyse their relevance in different stages of the industry life-cycle. Martinez et al. (2017) identify three service journeys of manufacturing companies (the well-being, the engineering, and the learning journey). Meanwhile, Lutjen, Tietze and Schultz (2017) describe the process of increasing servitisation from service initiation, to service anchoring, and to service extension. In their meta-analysis of 154 articles, Brax and Visintin (2017) identify eight different value constellations ranging from low to high levels of servitisation.

The transition from product- to service-centred logic is for most manufacturing companies associated with a number of challenges related to development and organisation of resources and processes (Koskela-Huotari et al., 2016). Consequently, a different stream of research in the

servitisation literature investigates barriers and challenges related to servitisation (e.g. Ulaga and Loveland, 2014). Often servitisation requires fundamental changes in the business logic and thereby impacts the current business model of the company. Some scholars investigate how and which elements of the business model can be affected by servitisation (Kindstrom and Kowalkowski, 2014, Shelton, 2009).

The financial impact of servitisation on companies' performance has been studied to a lesser extent. Eggert et al. (2014) find that the effect of services on profitability in engineering companies is contingent on the type of service and on whether companies have been product-innovative in the past. In an earlier study, Fang, Palmatier and Steenkamp (2008) find that a critical mass (20 – 30%) of services sales must be reached before positive effects on company value can be observed. Furthermore, this relationship is stronger for companies that have more resources available. Böhm, Eggert and Thiesbrummel (2017) confirm this finding and, in addition, observe that less financially healthy companies can manage the transition successfully if they focus on collaboration with suppliers.

Service Innovation

Academic discourse on service innovation is still fairly young and has not yet reached a consensus (Flikkema, Jansen and Van Der Sluis, 2007). Coombs and Miles (2000) analyse the development of service innovation research following three different perspectives: 1) an assimilation approach, transferring the theories and methods of product innovation to new service development, 2) a demarcation perspective, treating service innovation as fundamentally different in nature and character from product innovation, and 3) a synthesis perspective criticizing the former contrasting views and proposing an integrative perspective that is broad enough to encompass both service and product innovation. This latter multi-dimensional view of innovation is based on a neo-

Schumpeterian understanding that economic development is driven by the emergence of new combinations, which are (economically) more viable than previous solutions (Witell et al., 2016). Hence, by introducing new services, or new service-product combinations, manufacturing companies that aspire to servitisation are also service-innovative. The trend towards servitisation by manufacturing companies influences service innovation research to become more diversified (Carlborg, Kindstrom and Kowalkowski, 2014), since understanding how companies integrate solutions requires a wider perspective. In addition, from a theoretical point of view, SDL creates a paradigm-shift from goods- towards service-centred thinking (Vargo and Lusch, 2004, Vargo and Lusch, 2008), which contributes to this need for a multidimensional perspective and requires a re-examination of the role of services, service innovations, and their provision to the customer. As a result of these considerations, for this study a recent conceptualization by Skalen et al. (2015) is applied, which defines service innovation from an SDL perspective as "the creation of new value propositions by means of developing existing or creating new practices and/or resources, or by means of integrating practices and resources in new ways" (p. 137). This definition, which is in the tradition of the multidimensional view of service innovation and encompasses both new services and products or combinations of them, is the most appropriate for the context of the present study. The definition also stresses the importance of resources and processes that are necessary to develop service innovations.

Dimensions of service innovation

For operationalizing service innovation, many scholars (Barrett et al., 2015, Troilo, De Luca and Guenzi, 2017, Wooder and Baker, 2012) organise their conceptualization and research around three key dimensions: service concept, customer experience and service process. *Service Concept Innovation* refers to new elements of the service offerings and thereby describes the value proposition offered to the customer (den Hertog, van der Aa and de Jong, 2010). *Customer*

Experience Innovation refers to new ways of interacting with the customer, and the interfaces through which customers can experience the new service offerings. S*ervice Process Innovations* describe changes in the way (service) employees perform their work in delivering services (Miles, 2008). Research around these three dimensions of service innovation acknowledges that changing elements in one dimension may often require changes in one or both of the other two dimensions, depending on the nature and the degree of change and novelty introduced (Barrett, et al., 2015). This conceptualization is also adopted for the empirical setting of this study because companies departing a product-oriented manufacturing world in the effort to introduce new services, will most likely have to engage in all three types of service innovation, specifically, if they aim for radical service innovations.

The term "radical" pertains to the distinction of innovations according to the degree of change or the novelty of an offer – a distinction that is well established in the innovation literature (Schultz, Salomo and Talke, 2013). In contrast to incremental innovations, which build on existing knowledge and involve small improvements of a product or process, radical innovations build on new knowledge or combine existing knowledge with new knowledge (Hill and Rothaermel, 2003). While incremental innovations improve performance along existing characteristics, radical innovations often allow performance leaps through application or recombination of new characteristics and attributes (Myhren et al., 2018). Customers demand improvements not only of services that already exist in the market, but they also look for entirely new services that can provide solutions for unsolved problems or that can offer fundamentally different approaches in comparison to what exists (O'Cass and Sok, 2013). Research on service innovation shows that in order to survive in highly competitive environments, companies must pursue radical innovations in addition to exploitative service innovation activities to achieve high perceived service quality and

company performance (Sok and O'Cass, 2015). The creation of radically new services is often also associated with a change in the resources that are needed and in how resources are deployed. For example, the degree of novelty of a service innovation may involve significant changes in the way, frequency, and type of co-creation between companies and customers (Gustafsson, Kristensson and Witell, 2012).

In the next section, the research model will be completed with the delineation of the four main axioms of the SDL, which will present the causal conditions explaining radical service innovation in the research model. The four axioms, Network of actors, Resource liquefaction, Resource density, and Resource integration allow for a multi-dimensional investigation into the phenomenon of service innovation among manufacturing companies. Through this lens recent important trends that have become critical to innovation can be considered such as digitalisation, value network partnerships, and customer co-creation. Figure 1 illustrates the research model.

Insert Figure 1 about here

The meta-theoretical foundations of SDL

The literature on SDL describes the shift from a *Goods-Dominant Logic* to a *Service-Dominant Logic* of management (Greer, Lusch and Vargo, 2016). The goods-dominant logic (GDL) is marked by a logic of separation between the production of goods (the manufacturer domain) and the customers' use of the product (the user domain) (Vargo and Lusch, 2004). This GDL is substituted by a SDL, where the artificial distinction between the tangible product and the less tangible service that surrounds the product is replaced by a focus on the value that is generated from the use of the product-service offering. In SDL, goods are appliances that serve as alternatives to direct service provision, and goods are also aids to the service process (Lusch and Nambisan, 2015). In this sense,

goods are hired by the customer to get a job done (Bettencourt and Ulwick, 2008). And when money is involved in exchange, it represents the right to future services (Greer, Lusch and Vargo, 2016).

SDL and its emphasis of cross-fertilisation between products and services also requires a revised perspective on innovation. Lusch and Nambisan (2015) illustrate how an inventor, entrepreneur, or innovator should view service as a transcending mental model for all types and forms of innovation. Therefore, the distinction between product and service innovation becomes obsolete as all product innovations are (also) service innovations.

For over a decade, literature on SDL has evolved from 10 foundational principles into four main axioms (Barile et al., 2016, Vargo and Lusch, 2016). These axioms (Lusch and Nambisan, 2015) are summarized as follows:

1) **Network of actors**: SDL seeks to extend the understanding of the producer-customer relationship to include a wider range of actors that are all relevant for value creation (Wynstra, von Corswant and Wetzels, 2010). A dyadic perception of the division between the manufacturer and the user domains is supplemented by a perspective whereby more than the usual actors should be seen as potential contributors and co-creators of value (Story et al., 2017, Vargo and Lusch, 2017) and value propositions (Skalen, et al., 2015). Because Small and Medium-sized Enterprises (SMEs) have limited resources, a wider network of co-creators is especially important for SMEs' ability to enhance their innovation capabilities. Research shows that SMEs can strongly benefit from various collaborations with different external partners and institutions (Brunswicker and Vanhaverbeke, 2015), and that breadth and depth of external co-creation significantly improves SMEs' ability to introduce both radical product innovations as well as service innovations (Lee et al., 2010).

2) **Resource liquefaction:** From an SDL perspective, value is not bounded by the physical artefact to the same extent as in the past. Digitalisation increases the confluence and mixing of networks of people, machines, algorithms, representations, and information in digital spaces (Coreynen, Matthyssens and Van Bockhaven, 2017, Pohlmann and Kaartemo, 2017). For many companies, this form of resource liquefaction is an important means for service transition and service innovation (Ulaga and Reinartz, 2011). Digitalisation of assets and data exchange between industrial buyers and suppliers facilitate 'smart' servitisation (Kamp and Parry, 2017) and thereby also changes consumer preferences and consumption (Vendrell-Herrero et al., 2017). Although SMEs face significant challenges in taking full advantage of digitalisation opportunities (Del Vecchio et al., 2018), the use of big data and relevant information and communication tools is a proven relevant factor for SMEs' ability to increase their innovation capabilities and innovation performance (Scuotto et al., 2017).
3) **Resource density:** An important aspect of SDL involves the ability of actors to mobilise sufficient resources to create value for others or for themselves. SDL stresses the distinction between operand resources that are factors, on which operation is to be performed, as opposed to operant resources, which are employed to produce an effect (Vargo and Lusch, 2004). Operant resources are often intangible and reside in the core competencies and capabilities of a company. The more interconnected they are the more sustainable and harder to imitate are they (Madhavaram and Hunt, 2008). Operant resources are therefore essential for achieving competitive advantage. Resource density considers the ability of companies to possess, activate and combine the necessary resources to provide value to the market (Lusch, Vargo and Tanniru, 2010). It describes how well a company can use its operant resources to respond to market needs, make relevant new value propositions therefore provide new service solutions (Melton and Hartline, 2013, Vargo and Lusch, 2004). Prior

research on SMEs establishes that the ability to mobilise the right internal and external resources significantly influences speed, quality and performance of new service development (Santos-Vijande, Lopez-Sanchez and Rudd, 2016).

4) **Resource integration:** SDL builds on the idea that value creation depends on the context in which the offering is generated. Elements such as the infrastructure and the surrounding institutions within the ecosystem can both promote and limit the perceived value of the offering. This approach to value creation has similarities to the literature on architectural innovation (Garcia and Calantone, 2002) and Schumpeter's seminal work on the recombination of resources, capabilities and knowledge (Ngo and O'Cass, 2012, Schumpeter, 1934). Proximity to customers is an important aspect from the perspective of co-creation and value creation of services and the resulting value-in-use experienced in certain (social) contexts (Perks, Gruber and Edvardsson, 2012) stresses the essentiality of proximity to the customers. The line of argument is that the closer the company is to the customer when designing the value proposition for the new service, the fewer surprises it can await when launching the service offering and the higher the customer's value-in-use will be (O'Cass and Sok, 2015). Customer participation may thereby significantly increase the odds of successfully translating innovation capabilities into new service offerings (Ngo and O'Cass, 2013). Similarly, prior research on open innovation practices among SMEs emphasises the role of customer involvement along with an often informal customer interaction during the innovation process (van de Vrande et al., 2009).

The four points outlined above indicate how SDL integrates both intra- and inter-organisational aspects of perspectives about company offerings. The actor network perspective is aimed at individuals both inside and outside the company. Similarly, the perception of resources is marked

by boundary-crossing between the company and its surroundings. Accordingly, a transcendence between products and services is mirrored by transcendence of factors within and beyond the focal company.

METHODOLOGY

This article employs a multiple case study approach to investigate the research question. The data consists of qualitative interviews and secondary materials from 24 business-to-business manufacturing SMEs. These cases were selected based on theoretical sampling (Eisenhardt and Graebner, 2007). Hence, the cases are suitable for shedding light on and extending the insights into service innovation within manufacturing companies. The anticipation of relevance of the cases is based on the following elements:

1) The companies are small and medium-sized manufacturing companies that previously have been focused on product sales. Their prior orientation towards services has been of a sporadic nature where services have not been a key focus as a means to generate turnover.
2) The case companies all participated in publicly funded programmes aimed at an enhanced focus on services as part of their business activities. These programmes included various activities such as presentations from consultants and other practitioners working with service innovation and servitisation, workshops together with other companies with the same strategic ambitions of service innovation and servitisation, etc.

Table 1 presents the 24 cases in terms of number of employees, turnover, revenue, their product(s), the services that they have introduced to the market, and the number of interviews carried out in each of the companies.

Insert Table 1 about here

As a first data source, a total of 60 in-depth interviews were carried out with the case companies. The interviewees were primarily service managers responsible for the implementation of the servitisation strategy. In some cases (Beta, Gamma, Epsilon, Eta, Kappa, Xi, Sigma, Psi and Omega), the persons that were initially interviewed, suggested a follow-on interview with other employees within the organisation to better discuss additional aspects of service innovation. In some of these cases, the R&D Manager was interviewed to gain knowledge about IT-oriented issues of the transition. In several of the case companies, it was possible to carry out interviews over a longer period. Hence, for instance in Beta, Gamma, Epsilon, Eta, Kappa, Mu, Xi, Omicron, Pi, Sigma, Upsilon, Phi and Psi, the interviewees suggested to be interviewed once the servitisation strategy was closer to being fully implemented.

The interviews were semi-structured: They followed an interview guide that ensured that the central issues of the service innovation were discussed but at the same time, the interviews opened themes, which the interviewee found relevant and which were not immediately covered in the interview guide.

As a second source of data, some case companies allowed access to do additional observations. These observations were carried out during strategy sessions, company presentations, customer meetings and development workshops at for instance Gamma, Epsilon, Eta, Sigma, Phi and Psi, and were documented through first descriptive and then reflexive notes (Creswell, 2006).

The third data source consists of other documentation. Alpha, Beta, Gamma, Delta, Eta, Kappa, Mu, Omicron, Rho, Sigma, Phi and Psi granted access to confidential or internal material such as

strategy papers, customer/market analyses, technology reports etc., which were relevant for the servitisation strategy.

The data analysis employed a combination of an inductive and a more deductive approach. The inductive approach (Corley and Gioia, 2004) was carried out through an open coding of the data material: It identified all parts of the data that were relevant for the company's approach to services. Following the guidelines for inductive research, this part of the process was kept as descriptive as possible (Hargadon and Sutton, 1997). Secondly, the various coded pieces of material were clustered together based on axial coding into higher-order themes. Finally, these themes were gathered into several overarching dimensions that could be linked to the four foundational principles of SDL.

The data analysis was done in a nonlinear process, as it was carried out recursively with a number of iterations of the three stages (Locke, 1996).

The coding used the text analysis software programme NVivo, which is a common tool for qualitative text analysis (Bazeley, 2007, Vlaar, Van Den Bosch and Volberda, 2007). As stated by Gummesson (2003), software can assist but must not take over interpretation of qualitative data sources. Interpretation requires an ability to continuously learn about a given process and develop the understanding of what is happening in the project. Based on these considerations, the article employs various types of data analysis validation. The researchers involved in the research programmes carried out an 'external' analysis of the generated data as follows: through triangulation (Denzin, 1978) of field notes and other sources of data, they sought to establish a common understanding of the development. In addition to the external data analysis, the researchers conducted respondent validation of the findings from the various case studies. Finally, the researchers followed a member-check procedure (Lee and Baskerville, 2003), presenting their

perception of the cases to the initial interviewees and other participants within the companies. This external-internal exchange of perceptions generated new knowledge about the cases and valuable input for the analysis.

A main theme for triangulation was the assessment of the innovativeness of the service offerings of the case companies. The company interviewees were asked to assess their service innovativeness. To validate this self-assessment, three experts did an assessment of the service innovativeness of the 24 case companies. These three experts were:

1) a university researcher with substantial knowledge about service innovation and servitisation of product-oriented companies,

2) an innovation consultant from one of the Danish Research Technology Organisations (an organisation with the mission to supply knowledge to companies and industry (Barge-gil and Modrego, 2011)) , and

3) a practitioner, whose assessment was built on extensive experience as a service director from various international corporations within the wind industry, utilities, transportation and infrastructure.

The experts were asked to assess the innovativeness of the case companies on the three dimensions of service innovation: *Service Concept Innovation*, *Customer Experience Innovation* and *Service Process Innovation* (as described in the Theoretical Framework of the article). The experts used a 10-point scale from non-innovative to radical service innovative.

The inductive coding process was used as input to the more deductive process of exploring the potential link between the theoretical constructs of SDL and the service innovativeness of the case companies. To accomplish this exploration, the researchers used fsQCA (Sjodin, Parida and

Kohtamaki, 2016) and the software tool fsQCA 3.0 (UC Irvine, 2017). fsQCA is marked by several advantages. The analytical framework is based on equifinality whereby several paths or combinations can lead to the same outcome (Sjodin, Parida and Kohtamaki, 2016). As a second advantage, fsQCA allows asymmetry, which means that it is suitable for analysis of both the presence and the absence of a given construct in a configuration (Hofman, Faems and Schleimer, 2017). Finally, fsQCA is less vulnerable to representativeness of the cases in the sample than standard econometric methods. The calibration into set membership, which is founded on substantive knowledge about the cases and the theoretical framework and, hence, not reliant on traditional quantitative characteristics, diminishes the essence of representativeness (Fiss, 2011).

The coding procedure of the empirical material is presented in Table 2. Appendix 1 presents two examples of the coding of case companies.

Insert Table 2 about here

RESULTS

This section presents results of the fsQCA in combination with more qualitative findings from the case studies, which were analysed to test the model and determine operationalization configurations that lead to a presence or absence of Service Concept Innovation, Customer Experience Innovation, and Service Process Innovation.

Configurations for Service Concept Innovation

The table below presents the configurations related to the presence and absence of Service Concept Innovation.

Insert Table 3 about here

Three configurations of causal conditions represent recipes for the presence, while two configurations lead to an absence, of *radical Service Concept Innovation*. The three recipes leading to presence of Service Concept Innovation have an overall solution consistency of 0.81 (i.e., the degree to which membership in the configuration is a subset of membership in the outcome (Ragin, 2008)). The overall solution coverage (which can be interpreted as variance explained by the three configurations (Forkmann et al., 2017)) is 0.84. The overall solution consistency and solution coverage leading to an absence of the outcomes described above are 0.90 and 0.81 respectively.

The first configuration recipe for the presence of Service Concept Innovation (Solution SCI-P1) consists of the combination of *Network of actors* as a core condition (i.e. being causally more essential than the peripheral conditions (Forkmann, et al., 2017)) and *Resource integration* as a peripheral condition. Solution SCI-P1 indicates that for some of the cases, there is a strong causal relationship between collaboration within the value chain in combination with customer integration (though peripheral) on one hand and the radicalness of the *Service Concept Innovation* on the other. While the configuration is empirically relevant, the unique coverage of the configuration (the proportion of memberships in the outcome explained solely by each individual solution term and not by other solution terms (Ragin, 2008)) is limited to 0.01. The other two configurations leading to a presence of *radical Service Concept Innovation* represent a higher unique coverage (each scoring 0.05). Hence, the combination of *Resource liquefaction* and *Resource density* (Solution SCI-P2) has a consistency of 0.95 and a raw coverage of 0.68. Furthermore, Solution SCI-P2 illustrates that digitalisation (indicated by *Resource liquefaction*) in combination with strong intra-organisational gearing and management (indicated by *Resource density*) tends to lead to a presence

of *radical Service Concept Innovation*. Solution SCI-P3 consists of the combination of digitalisation (*Resource liquefaction*) and customer involvement (*Resource integration*) but absence of value chain integration (*Network of actors*). This configuration represents an empirically relevant configuration for *radical Service Concept Innovation*.

There are two configurations (Solution SCI-A1 and Solution SCI-A2) leading to an absence of *Service Concept Innovation*. Both configurations consist of absent *Resource liquefaction* as a core causal condition. First, absent *Resource liquefaction* as a core condition in combination with an absence of *Resource integration* as a peripheral causal condition (Solution SCI-A1) represents a consistency, raw coverage score, and unique coverage score of 0.91, 0.61 and 0.02 respectively. The combination of absent *Resource liquefaction* as a core causal condition in a configuration with absence of *Network of actors* (Solution SCI-A2) has respective scores of 0.95, 0.68 and 0.05.

Conclusively, Solution SCI-P2 for the presence of *Service Concept Innovation* seems to hold the strongest empirical relevance since it is marked by both core conditions (lacking in Solution SCI-P3) and highest unique coverage (low in Solution SCI-P1). Absence of *Resource liquefaction* is the core condition in both the solutions leading to absence of *Service Concept Innovation* (Solution SCI-A1 and Solution SCI-A2).

Configurations for Customer Experience Innovation

Table 4 below presents the configurations of causal conditions for *Customer Experience Innovation*.

Insert Table 4 about here

Three configurations lead to the presence of *radical Customer Experience Innovation* (with a solution consistency/coverage of 0.95/0.65). In all three configurations *Network of actors* and

Resource Liquefaction are core conditions. In combination with absence of *Resource integration* (as a peripheral condition) the consistency, raw coverage and unique coverage are 0.97, 0.60 and 0.05 respectively. The *Network of actors* and *Resource liquefaction* in combination with presence of *Resource density* represent a configuration for presence of *radical Customer Experience Innovation* (Solution CEI-P1) with a consistency, raw coverage and unique coverage of 1.00, 0.56 and 0.03 respectively. The *Network of actors* and *Resource liquefaction* in combination with absence of *Resource density* represent a configuration. However, this configuration (Solution CEI-P2) is merely an empirical observation and not a theoretically meaningful configuration: *Resource density* is operationalised as an organisational capability to introduce service innovation, and theoretically the absence of this causal condition cannot lead to presence of *Customer Experience Innovation*[1].

The two configurations for absence of *Customer Experience Innovation* (Solution CEI-A1 and Solution CEI-A2) with an overall solution consistency/coverage of 0.84/0.79 have absence of *Network of actors* and *Resource liquefaction* in common as core conditions. Combined with *Resource density* and *Resource integration* as core conditions, the configurations have a consistency, raw coverage and unique coverage of 0.84/0.90, 0.72/0.66 and 0.14/0.07 respectively.

In conclusion, the two causal conditions, *Resource liquefaction* and *Network of actors* are core causal conditions in all configurations in relation to the outcome *radical Customer Experience Innovation*. And the absence of these two causal conditions is also part of both configurations leading to absence of *radical Customer Experience Innovation*.

Configurations for Service Process Innovation

[1] As described in *Appendix 2: Analysis design*, the condition Resource Density is analysed as present but not absent in the fsQCA software. Absence of Resource Density as a condition for presence of any of the three outcomes is not theoretically meaningful.

The configurations for *radical Service Process Innovation* are presented in Table 5. There are no empirically relevant configurations for the absence of *radical Service Process Innovation*.

Insert Table 5 about here

As illustrated in the table, the configuration consisting of *Network of actors* in a combination with the absence of *Resource liquefaction* (both core conditions) and *Resource integration* (peripheral) (Solution SPI-P1) represent the highest unique coverage (0.05) and a consistency/raw coverage of 0.91/0.55. The two remaining configurations both consist of *Resource liquefaction* and *Resource density* as core conditions. In combination with absence and presence of *Networks of actors* and *Resource integration* as peripheral conditions, these two configurations (Solution SPI-P2 and Solution SPI-P3) represent a consistency, raw coverage of 0.97, 0.58 and 0.03, and 1.00, 0.59 and 0.02 respectively. The three solutions represent an overall consistency/coverage of 0.89 and 0.70.

DISCUSSION AND IMPLICATIONS

The purpose of this study was to answer the research question: *"What different paths do manufacturing companies follow to launch radical service innovations?"* The discussion presents the findings that go across all dimensions of service innovation as well as findings that are more particular to one or two of the dimensions. The discussion is divided into the four causal conditions of SDL.

Digitalisation

Enhancing digitalisation of the business environment is likely to foster extended network confluence for service delivery (Pohlmann and Kaartemo, 2017). The present analysis illustrates the importance of a data-rich environment for the case companies. *Resource liquefaction* is the common

denominator of the bulk of the configurations leading to the three dimensions of radical service innovation. Hence, for manufacturing business-to-business SMEs the launch of radical service innovations tends to depend on a certain level of digitalisation.

Literature on Big Data discusses two dimensions of the digital age (George et al., 2016): 1) a *scope* dimension, which is aimed at the mere volume of data; and 2) a *granularity* dimension, which reflects the depth of insights that the data hold. Other studies on Big Data and digitalisation (McAfee and Brynjolfsson, 2012) describe the three V's of data: Volume, velocity (which are primarily concerned with the scope dimension of George et al. (2016)), and variety (which is primarily related to the granularity dimension). As the case stories presented in the appendices illustrate, the companies are employing a wide range of sources of data as a means to service innovation. Hence, in some cases the companies digitalise their own handling of internal data sources. In other cases, the companies seek access to entirely new data through sensor technology installed with the customer. A general impression is that as a means for radical service innovation, the case companies are oriented towards understanding the granularity of the data, to which they already have some level of access, rather than seeking to increase the scope of data. In other words, the digitalisation is more a question of utilising their existing data than nurturing new data sources from, for instance, open data sets (Barile, et al., 2016). These findings can be a consequence of characteristics of the selected case companies: The analysed companies are SMEs and generally do not have in-house resources capable of carrying out advanced data analyses.

The cases also illustrate how access to the data among the customers has become a gateway to customer insights without continuous, direct interaction with the customer. In the discussion about Customer Integration (below), it is further described how digitalisation is a means to customer proximity without over-dependence on the immediate customer preferences.

The network of actors

A central finding from this study is that digitalisation is not a necessary nor a sufficient condition alone for any of the three service innovation outcomes. Hence, digitalisation only leads to radical service innovation when it is combined with other causal conditions.

SDL emphasises the role of collaboration with a broader set of actors beyond the immediate customer-supplier relationship (Lusch, Vargo and Tanniru, 2010). The *Network of actors* tends to be a prominent causal condition for the launch of *radical Customer Experience Innovation*. For example, smartphone apps are customer interface solutions that give customers access to real-time data, and creating these apps requires digitalisation to be combined with supplier collaborations that can ensure the right level of details and integration of the solution.

Collaboration within the broader network is often necessary for accessing required resources which the focal company lacks access to internally. Providing new service offerings (e.g., related to customer experience) often requires some level of insight into datafication and data analytics. Also, collaboration to find solutions within a broad set of network partners is often a good alternative to buying the resources from outside the network. Both Alpha and Sigma (see case stories in the Appendices) have chosen to engage in collaborations with researchers and students at universities to develop their service concept.

Solution SCI-P1 on the presence of *radical Service Concept Innovation* and Solution SPI-P1 on the presence of *radical Service Process Innovation* indicate that collaboration among the network of actors can generate radical service innovation and service process innovation without the presence of other causal conditions. These configurations are exemplified in some of the case stories (for instance Iota) where the close collaboration with a supplier and their sharing of insights about some

of the end-customers led to development of a period-based service concept that was new to the market.

Mobilisation of resources

In the configurations leading to the three dimensions of radical service innovation, *Resource density* is defined as a present causal condition (see Appendix 2 for the *Analysis Design*). Hence, a finding indicating the absence of *Resource density* in Solution CEI-P2 for the presence of the outcome *Customer Experience Innovation* is indeed a peripheral causal condition and not a theoretically valid finding. However, an interesting finding from the fsQCA is that in some of the configurations other causal conditions seem to substitute for *Resource density*. For instance, in Solution CEI-P1 the presence of *radical Customer Experience Innovation* is not depending on *Resource density*. Instead, digitalisation (*Resource liquefaction*) and collaboration with the value chain in general (*Network of actors*) are sufficient causal conditions for the outcome. These results indicate that mobilisation of resources (which is primarily a managerial task within the case companies) is often a prerequisite for launching radical service innovations to the market. Managers of the focal company need the ability to convert data from digital technologies into value. But, as an additional finding, there might be a trade-off relationship between *Network of actors* and *Resource density*, i.e. that resources may be mobilised also outside the company through the network actors. A possible lack of own resources therefore could be compensated through external network partners. This is for example what happened in the Alpha case (see the case vignette in Appendix 5).

Customer interaction

Prior studies on customer integration and customer solutions note the occurrence of continuous involvement of the customer when developing new offerings to the market. Proximity to the customer and access to information about customer preferences is a cornerstone in SDL (Tuli, Kohli

and Bharadwaj, 2007) because it makes it possible for the supplier of the offering to continuously develop and adjust the offering in line with actual customer needs.

The analysis does not establish that the customer is irrelevant in the launch of radically new services. The needs and perceptions of the customer are permanently on the agenda of the case companies. However, the case analyses indicate that direct resource integration through, for instance, co-creation and continuous interaction with one or few customers does not tend to lead to radical service innovation. Interestingly, a limited role of *Resource integration* for all three dimensions of radical service innovation has been found in this study. The assumption that at least *Customer Experience Innovation* would necessitate a certain degree of customer involvement was not verified as the analysis of the configurations in Table 4 illustrate. Rather, the presence of *Resource integration* is a peripheral condition in Solution CEI-P3, not present in Solution CEI-P2 and absent (though peripheral) in Solution CEI-P1.

The case vignettes (see Appendix 5) illustrate how the launch of radical service innovation depends to a certain degree on an arms-length approach to immediate customers, who tend to promote 'idiosyncratic' solutions with limited scalability to other existing and potential customers.

The point is not that the case companies have detached themselves from customer preferences; rather, they seek to incorporate a wider perspective on the offering and not to just follow one particular customer's preferences. An overly keen focus on customer preferences tends to lower the innovation ambitions and outcomes.

These findings echo prior studies on the involvement of external actors in the innovation process. Knudsen & Mortensen (2011) find that the use of external relationships might have a negative impact on product development performance. Similarly, Gustafsson et al. (2012) describe how

companies should frequently verify the direction of the development of the offering but should not be dictated by the preferences of few customers.

An interesting finding from the cases is the relationship between digitalisation and customer involvement. For some of the cases (for instance Beta, Delta and Nu) access to an internal database of customer information substitutes the need for continuous involvement of the customer. The data generated by sensors within the installed base make it possible for the case companies to have a direct impression of the use situation (for example improper use of the machines) and the production data (for instance downtime of the machine). Analyses of these real-time data from installed machines provide essential insights for the case companies when developing the use cases and, in turn, the business case and value propositions that the company can present to the customer (as occurs, for example, with Beta).

Theoretical implications

In this study fsQCA was used because it is designed to offer explanations about the way theoretical concepts are related to each other (the 'how' and 'why' in a theoretical model (Whetten, 1989)); and this article posits *why* the four principles of SDL are related to the radicalness of service innovation and *how* they relate in various ways. This article contributes to several streams of research. First, the present study adds to the literature on servitisation of manufacturing companies through the focus on the ability of these companies to introduce radical service innovations. It deepens the understanding of radical service innovations by operationalizing service innovation as a multidimensional construct consisting of service concept innovation, customer experience innovation and service process innovation. This allows for a more differentiated picture of how four axiomatic SDL factors (network of actors; resource liquefaction; resource mobility; and resource

density) can be integrated in different configurations of service innovation design. With the four dimensions of SDL different paths are illustrated that can lead to presence or absence of radical service innovation and thereby this study responds to recent calls for investigating how companies should organise their resources for radical service innovation (Snyder, et al., 2016). The sample consists of SMEs and therefore this study is indicative of how companies with limited resources may achieve radical service innovations.

SDL provides a valuable framework for investigating how radical service innovations can be achieved. Because SDL covers the four main axioms, this article extends the knowledge about each of these dimensions. For the network of actors dimension the findings corroborate the importance of external networks for SMEs (Lee, et al., 2010) in achieving radical service innovations. The results of this study highlight that for SMEs, digitalisation is an essential factor to create radically new services. Even if SMEs may have more challenges with digitalisation (Scuotto, et al., 2017) the present findings point out that it is an impactful route towards radical service innovations. In several configurations, network of actors and resource liquefaction appeared together, which indicates that their combination may generate significant synergies when thinking about how to organise for radical service innovation. Digital technologies open the boundaries of companies to interact with more partners and thereby increase the heterogeneity of resources possibly to be combined (Yoo et al., 2012). More knowledge combined with resource heterogeneity increases the chances to create something radical and outstanding, but at the same time also increase the need for effective and efficient resource integration and mobilization.

Finally, the results also extend the literature on the role of customer integration in new service development. SMEs tend to make investment decisions and innovations triggered by immediate customer needs and this intensive customer-orientation can make the companies risk-averse in

relation to introducing too many novel elements into the offering (Grimpe et al., 2017). While previous studies (Ngo and O'Cass, 2013) advocate for a positive relationship between customer integration and service innovations, the presented results do not particularly highlight customer integration as an important factor. Several explanations may be offered: first, this article investigates radical service innovations, and it has been previously shown that for radical innovations customer integration is not necessarily beneficial or not equally beneficial in different stages of the service development (Melton and Hartline, 2015); second the sample of the present study consists of manufacturing SMEs striving to servitise their offerings – this may make an important difference in the self-conception of how to pursue innovation. Service companies from the outset may have a greater proximity to the customer and may use their services to integrate the customer as a resource. Manufacturing companies on the other hand may be more reluctant (or less successful) in integrating the customer as a resource and may instead try to pursue other paths that lead to radical service innovations.

Managerial implications

This study offers three managerial implications for manufacturing companies that seek to be more service innovative.

A first implication relates to the role of digitalisation for leveraging radical service innovation in SMEs. To realise the potential of digitalisation (i.e., to achieve what can be called the 'fourth V' of data – value (Lycett, 2013)), the company needs to acknowledge the managerial challenges of data-driven innovation (Lavalle et al., 2011). Managers of SMEs should therefore introduce the right steps towards digitalisation that allow for effective and efficient use of data. Digitalisation is not self-sufficient to achieve radical service innovation. Rather it is a factor that should be combined

with others. Especially important is an ability for the company to mobilise the necessary resources (whether internally or externally) to capitalise on digitalisation.

This leads to a second implication that highlights the importance of the expanded pool of resources among partners within the value network. The case studies illustrate that collaboration (together with digitalisation) can represent a path to radical service innovation. Identifying relevant partners and establishing productive relationships with them are central challenges for managers in the effort to be more service innovative.

The final managerial implication concerns interactions with customers as part of the service innovation effort. Companies seeking to introduce radical service innovation should be aware of a role of their existing customers. These customers should play a central role in the understanding of the value proposition guiding the development of the service innovation. However, when a company wishes to develop more radical service innovations, it should not be over-reliant on preferences of immediate customers since these customers might be too narrow in their perceptions of needs or potentials for future service offerings.

LIMITATIONS AND FUTURE RESEARCH

Some limitations of the present study should be highlighted to give direction to future studies.

The first limitation lies within the case-based method presented in this article. The set-theoretical approach is suitable for a deeper understanding of the relationship between theoretical concepts, and the present study is an effort to develop the theoretical link between the causal conditions derived from SDL on one hand, and (radical) service innovation as an outcome on the other. However, fsQCA is a non-parametric method and the generalisability of the findings from the study is not a concern of the method. The empirical context, on which this article is based, consists of primarily

small and medium-sized business-to-business manufacturing companies. Hence, the purpose for sampling of the case studies was carried out not in order to ensure the possibility to extrapolate the findings to a larger population, but rather to search for a theoretical generalisability and theory-building (Eisenhardt, 1989). Future studies could feasibly try to explore the relationship between the theoretical concepts in a more quantitative setting with a representative sample.

A second line of research that is only partially discussed and understood in the present study is the role of customer involvement in the development of service innovation. This study has been unable to differentiate between various kinds of customers and the findings related to negative aspects of customer involvement in terms of the chances to launch radical service innovation is based on case-specific insights. Future quantitative or qualitative studies could potentially seek to explore whether some customers could be more suitable than others for companies to involve. A possible inspiration could be derived from the literature on lead users, which has hitherto been oriented mostly towards business-to-consumer settings (Stockstrom et al., 2016, von Hippel, 1986).

A third avenue for future qualitative or quantitative studies could be the role of digitalisation. In the present study, digitalisation is discussed as a broad term that covers everything from handling internal data in a systemised manner to embracing advanced predictive analytics in relation to the installed solutions with the customers. Future studies could try to differentiate between the levels of advancement of the digitalisation and perhaps try to uncover whether there are several dimensions to digitalisation of companies (for example internal data vs. external data) in the paths toward radical service innovation.

Finally, a limitation is that the present study does not analyse performance of the radical service innovations. Addressing this shortcoming may explain why some companies are able to generate

greater profitability than others, so future studies could feasibly explore whether some of the paths to radical service innovation are marked by better financial performance than others.

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Figure 1: The research model

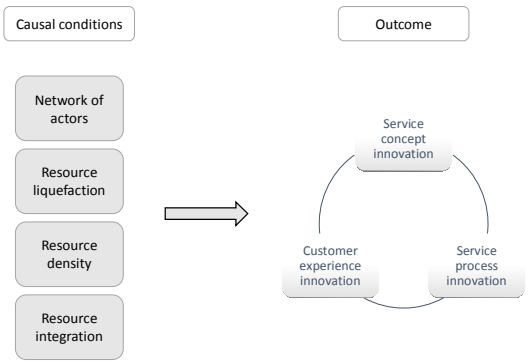

Table 1: The case companies

Case	Number of employees	Turnover (2016) K€	Profit (2016) K€	Product	Focus of the service innovation	Number of interviews
Alpha	397	58.164	854	Energy surveillance products	Constant feedback on energy performance	2
Beta	197	38.700	2.266	Oil filters for maritime companies	Surveillance of the status of the oil	2
Gamma	23	*	242	Telephony communication devices	Business communication analysis and management	6
Delta	27	*	74	Welding machines and other production tools	Common platform for sharing production facility	2
Epsilon	15	*	-507	Smart home devices	Real-time surveillance of home appliances	5
Zeta	35	172.981	-17.006	Safety equipment	Remote surveillance of installed base offshore	2
Eta	140	*	548	Poultry systems	Climate control systems and surveillance	2
Theta	57	*	67	Automation systems for food processing	Predictive maintenance	2
Iota	150	227.804	21.047	Producer of transport technology	Total service provider from factory to production facility	2
Kappa	162	187.924	17.671	Provider of components for wind turbines	Process optimisation for the customer base	3
Lambda	75	*	2.121	Producer of electrical panels	Controlling system for products	3
Mu	53	*	362	Organic meat products	Organic ready-made meal service	3
Nu	44	*	5.114	Producer of nail machines	Provision of an extranet with machine information	2
Xi	206	93.019	-2.289	Machine component provider	Value added service provider	2
Omicron	10	*	130	Provider of metal components	Facility surveillance	2

Pi	37	*	443	Components and systems for industrial heating	System and solution service partner	2
Rho	20	*	169	Producer of measuring equipment	Common on-site customer platform for self-service	1
Sigma	289	76.541	6.978	Equipment for ventilations and climate control in poultry production	Climate surveillance and resource optimisation for climate control	3
Tau	17	*	106	Automation equipment for industry	Real-time surveillance of automation solutions	2
Upsilon	15	*	11	Rubber coating for tires (merely product sales)	Fleet management within the field of tires	3
Phi	93	*	3.569	Provider of printers for marking in food industry	Total provider of print solutions	4
Chi	23	*	117	Machinery for industry	Provider of leasing solutions of the machines	1
Psi	141	38.112	4.415	Supplier of equipment and components to the gas industry	Process delegation services	2
Omega	152	34.373	1.694	Supplier of logistics equipment	Real-time surveillance of components at the customer site	2

* The turnover was not reported by the company

Table 2: Coding procedure

Element	Theoretical Construct	Definition	Coding scheme – 6-value fuzzy sets (0.0; 0.2; 0.4; 0.6; 0.8; 1.0)	Method of assessment	Key sources
Causal conditions	Network of actors	Collaboration within the broader value chain in which the focal company is embedded	**Fully out ("0")**: The focal company works in isolation from other actors in the value chain **Fully in ("1"):** The focal company is working together with other actors in the value chain both broadly (with a wide range of other companies) and intensively (with a high frequency)	• Coding of interviews and other sources in NVivo • Triangulation with experts	(Ritter and Gemünden, 2003) (Kohtamaki et al., 2013) (Aarikka-Stenroos and Sandberg, 2012)
	Resource liquefaction	Extent of digitalisation	**Fully out ("0")**: The focal company is marked by a low degree of digitalisation **Fully in ("1"):** The focal company is marked by a large degree of digitalisation (in a wide range of business areas (customer relations management, production management, surveillance of installed base etc.) and intensively (to a high level of complexity within a given business activity)		(Bharadwaj et al., 2013) (Coreynen, Matthyssens and Van Bockhaven, 2017) (Vendrell-Herrero, et al., 2017)
	Resource density	Ability of the focal company to mobilise sufficient resources to create value	**Fully out ("0")**: The focal company has a low ability to mobilise basic resources **Fully in ("1"):** The focal company has a large ability to mobilise interconnected, operant resources		(Madhavaram and Hunt, 2008) (Lusch, Vargo and Tanniru, 2010) (Storey et al., 2016)

	Resource integration	Engagement with proximal customer in co-creation of services	**Fully out ("0")**: The focal company is marked by arms-length relations with customers in innovation **Fully in ("1"):** The focal company is marked by extensive interaction and co-creation with one or more existing customers		(Uzzi, 1997) (Ekman, Raggio and Thompson, 2016) (Gustafsson, Kristensson and Witell, 2012)
Outcomes	Service concept innovation	The extent to which the company introduces radically new services	**Fully out ("0")**: The focal company does not provide new services for the market **Fully in ("1"):** The focal company provides radically new services to the market	• Interviews with the companies • Expert assessments	(Witell, et al., 2016) (Oke, 2007) (Ettlie and Rosenthal, 2011) (Troilo, De Luca and Guenzi, 2017)
	Service process innovation	The extent to which the focal company innovate their internal systems	**Fully out ("0")**: The focal company does not innovate internal systems in order to offer value for the customer **Fully in ("1"):** The focal company innovates internal systems in order to offer value for the customer to a very high degree	• Interviews with the companies • Expert assessments	(Troilo, De Luca and Guenzi, 2017) (Ulaga and Reinartz, 2011)
	Customer experience innovation	The extent to which the focal company innovates services related to the customer experience	**Fully out ("0")**: The focal company does not innovate services related to the customer experience **Fully in ("1"):** The focal company innovates services related to the customer experience to a very high degree	• Interviews with the companies • Expert assessments	(Vandermerwe, 1994) (Lemke, Clark and Wilson, 2011)

Table 3: Configurations for presence and absence of Service Concept Innovation[23]

Configurations for presence and absence of Service Concept Innovation					
	Presence			Absence	
	SCI-P1	SCI-P2	SCI-P3	SCI-A1	SCI-A2
Network of actors	⊕		❍		❍
Resource liquefaction		⊕	⌖	❍	❍
Resource density		⊕			
Resource integration	❍		⌖	❍	
Consistency	0.90	0.95	0.87	0.91	0.95
Raw Coverage	0.66	0.68	0.61	0.61	0.68
Unique Coverage	0.01	0.05	0.05	0.02	0.05
Overall Solution Consistency		**0,81**		**0.90**	
Overall Solution Coverage		**0.84**		**0.81**	

Table 4: Configurations for presence and absence of Customer Experience Innovation

Configurations for presence and absence of Customer Experience Innovation					
	Presence			Absence	
	CEI-P1	CEI-P2	CEI-P3	CEI-A1	CEI-A2
Network of actors	⊕	⊕	⊕	❍	❍
Resource liquefaction	⊕	⊕	⊕	❍	❍
Resource density		❍	⊕		❍
Resource integration	❍			❍	
Consistency	0.97	0.97	1.00	0.90	0.84
Raw Coverage	0.60	0.58	0.56	0.66	0.72
Unique Coverage	0.05	0.03	0.02	0.07	0.14
Overall Solution Consistency		**0,95**		**0.84**	
Overall Solution Coverage		**0.65**		**0.79**	

Table 5: Configurations for presence of Service Process Innovation

[2] Note: For all the configuration tables, the figures should be read as:

⊕ : The causal condition is present and a core condition

⌖ : The causal condition is present and a peripheral condition

❍ : The causal condition is absent and a core condition

❍ : The causal condition is absent' and a peripheral condition

[3] The illustrations of the configurations are based on the development of Professor Peer Fiss at UC Irvine, and the use of the underlying spreadsheet is by courtesy of Professor Fiss: http://www-bcf.usc.edu/~fiss/stm%20links.html

Configurations for presence of Service Process Innovation

	Solution		
	SPI - P1	**SPI - P2**	**SPI - P3**
Network of actors	⊕	❍	⊕
Resource liquefaction	❍	⊕	⊕
Resource density		⊕	⊕
Resource integration	❍	❍	⊕
Consistency	0.91	0.97	1.00
Raw Coverage	0.55	0.58	0.59
Unique Coverage	0.05	0.03	0.02
Overall Solution Consistency		**0,89**	
Overall Solution Coverage		**0.70**	