

Theory development in servitization through the application of fsQCA and experiments

Theory
development in
servitization

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Abstract

Purpose – The purpose of this study is to explain how the application of fuzzy-set qualitative comparative analysis (fsQCA) and experiments can advance theory development in the field of servitization by generating better causal explanations.

Design/methodology/approach – FsQCA and experiments are established research methods that are suited for developing causal explanations but are rarely utilized by servitization scholars. To support their application, we explain how fsQCA and experiments represent distinct ways of developing causal explanations, provide guidelines for their practical application and highlight potential application areas for a future research agenda in the servitization domain.

Findings – FsQCA enables specification of cause–effects relationships that result in equifinal paths to an intended outcome. Experiments have the highest explanatory power and enable the drawing of direct causal conclusions through reliance on an interventionist logic. Together, these methods provide complementary ways of developing and testing theory when the research objective is to understand the causal pathways that lead to observed outcomes.

Practical implications – Applications of fsQCA help to explain to managers why there are numerous causal routes to attaining an intended outcome from servitization. Experiments support managerial decision-making by providing definitive “yes/no” answers to key managerial questions that address clearly specified cause–effect relationships.

Originality/value – The main contribution of this study is to help advance theory development in servitization by encouraging greater methodological plurality in a field that relies primarily on the qualitative case study methodology.

Keywords Servitization, fsQCA, Experiments, Causal explanation, Case study

Paper type Research Paper

1. Introduction

Servitization is an interdisciplinary field of study that seeks to understand a managerially relevant phenomenon. Over previous decades, it has become an established field of study that continues to generate an increasing amount of research output (Kowalkowski *et al.*, 2017).

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However, recent literature reviews reveal that exploratory and descriptive case studies tend to dominate the servitization field, while offering only limited and/or incremental advancement of theory (Annarelli *et al.*, 2016; Kowalkowski *et al.*, 2017; Baines *et al.*, 2017; Li *et al.*, 2020). In their analysis of over a thousand servitization studies, Rabetino *et al.* (2018, p. 362) make the following conclusion: “*Servitization-related research has been exploratory, with an overrepresentation of descriptive case studies that are not all theoretically driven and aimed at theory building*”.

One consequence of this is the lack of understanding of the causal pathways and contingencies that drive firm-level outcomes from servitization (Kohtamäki *et al.*, 2019; Zimmer *et al.*, 2020). For example, while we know that servitization can result in positive firm-level outcomes (e.g. Fang *et al.*, 2008; Worm *et al.*, 2017), the causal pathways that lead to these observed outcomes are not well understood.

Given the close interdependence between theorizing and the methods used to develop theory (Sørensen *et al.*, 2007), theoretical advancements in servitization would arguably benefit from greater methodological plurality. Consistent with this, several recent calls urge for greater methodological diversity in servitization (Kowalkowski *et al.*, 2017; Rabetino *et al.*, 2018; Li *et al.*, 2020; Rabetino *et al.*, this issue). In response to this, the *purpose of this study is to explain how the application of fsQCA and experiments can advance theory development in servitization through the generation of better causal explanations*. Both fuzzy-set qualitative comparative analysis (fsQCA) and experiments are established research methods that are suited for developing causal explanations but are rarely utilized by servitization scholars.

As an exploratory approach that builds on the study of cases, fsQCA enables researchers to uncover “different recipes for success” through a configurational logic (Forkmann *et al.*, 2017). fsQCA builds on the assumption of causal complexity and provides a systematic template for analyzing how configurations of conditions relevant to the studied topic interact to explain an outcome of interest (Furnari *et al.*, 2020). In contrast, experiments require strongly reduced complexity and enable the drawing of direct causal conclusions through reliance on an interventionist logic. Together, these methods provide complementary ways of developing and testing theory when the research objective is to understand the causal pathways that lead to observed outcomes.

The main contribution of this study is to help advance theory development in servitization by encouraging greater methodological plurality in a field that relies on the qualitative case study methodology (Kowalkowski *et al.*, 2017; Rabetino *et al.*, 2018; Li *et al.*, 2020; Rabetino *et al.*, this issue). To ground this contribution, we (1) discuss why theory development in servitization would benefit from adoption of methods that enable the building of causal explanations (c.f. Welch *et al.*, 2011); (2) provide an overview of how fsQCA and experiments have been applied in the servitization domain; and (3) highlight potential future application areas for these methods.

2. Theory development in servitization: from descriptive case studies toward causal explanations

Theory is a form of explanation that offers a coherent conceptualization of the phenomenon under study. Theory development requires defining key concepts and their interrelationships in ways that indicate “how and/or why a phenomenon occurs” (Corley and Gioia, 2011, p. 12); the resultant explanation must have both practical and scientific utility. In theory development, researchers can choose between semantic or syntactic forms of explanation (Abbott, 2004). Semantic explanations favor rich contextual description, while syntactic explanations explicate the structure of abstract dependencies (Marks and Gerrits, 2018).

While case-based theorizing tends to favor semantic explanations (Cornelissen, 2017), Welch *et al.* (2011) suggest that in developing theory, case-based researchers can make

choices along two key dimensions—*contextualization* (semantic) and *causal explanation* (syntactic)—and develop a typology that describes four alternative approaches for theory building through cases (see Figure 1).

Inductive theory-building and interpretive sensemaking provide opportunities for theory development with differential emphasis on contextualization. However, their main disadvantage is a weak emphasis on the development of causal explanations. For example, where inductive theory building (e.g. Eisenhardt, 1989, 1991) focuses on developing emerging theory from data, it can only propose associations and relationships between variables and constructs, thereby resulting in weak causal explanations.

Welch *et al.* (2011) observe that case researchers tend to favor either inductive theory building or interpretive sensemaking (shaded areas in Figure 1). Servitization scholars are no exception (see Annarelli *et al.*, 2016; Kowalkowski *et al.*, 2017; Rabetino *et al.*, 2018; Li *et al.*, 2020). For example, Baines *et al.* (2017) note that prescriptive and explanatory studies that consider causal explanations are an underdeveloped aspect of servitization.

Examples of well-cited inductive theory-building studies in servitization include Tuli *et al.* (2007) and Ulaga and Reinartz (2011). These studies de-emphasize the importance of contextual understanding and focus instead on identifying commonalities and patterns across the studied firms. For example, Tuli *et al.* (2007) draw on in-depth interviews with 49 managers in customer firms and 55 managers in supplier firms to formulate a set of propositions for how suppliers can successfully deliver integrated solutions.

The interpretive sensemaking approach (Stake, 1995) emphasizes rich contextual description and does not consider causal explanation as a necessary component in the theory building process (Welch *et al.*, 2011). As an illustrative example, Salonen (2011) utilizes in-depth case studies to explore how engagement in solution business can be interpreted as an enactment of the service-dominant logic among industrial manufacturers. Further, Biggemann *et al.* (2013) utilize in-depth case studies from the mining industry to develop a dynamic network perspective on solution processes.

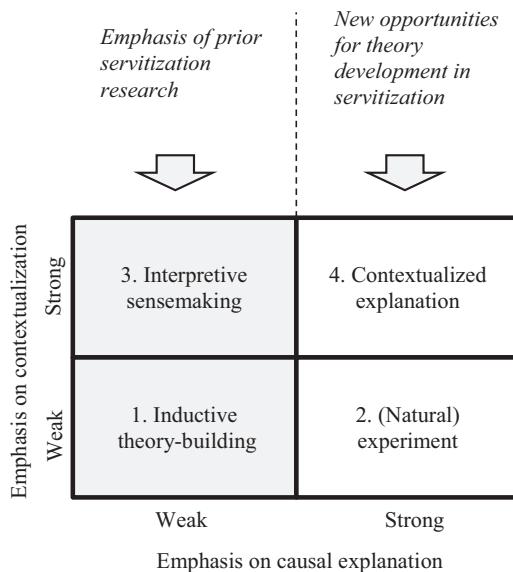


Figure 1.
Four methods of theorizing from cases (based on Welch *et al.*, 2011)

Application examples of quadrants 2 (natural experiment) and 4 (contextualized explanation) are rare in servitization. Nevertheless, as argued by Welch *et al.* (2011), case research can be used to develop causal explanations. For example, Yin (2009) contends that case studies can be treated as experiments to address “how and why” types of questions that establish causal relationships through the testing of propositions. In fact, as noted by Welch *et al.* (2011, p. 746), “Many of the procedures that Yin (2009) advocates—such as replication logic, pattern matching and time-series analysis—are adaptations of experimental techniques” and can be used to test specific causal patterns.

As indicative examples of quadrant 2, Welch *et al.* (2011) refer to Buck and Sharim (2005) from the international business domain to explain how the study of a least likely case can be used to test a causal proposition; they also refer to Howells (2002) who develops a rival explanation by re-evaluating a previously reported case. From the servitization domain, Salonen and Jaakkola (2015) employ a comparative case study approach and apply well-established firm boundary theories to develop rival explanations regarding why firms choose internal or external resource integration approaches for servitization.

Further, studies in quadrant 4 focus on identifying multiple causal pathways (i.e. equifinality) that lead to the same outcome under different conditions (Welch *et al.*, 2011). Thus, contextual explanations preserve the richness and detail of traditional case studies, while also invoking stronger modes of causal logic and explanation. As examples from the servitization domain, Ceci and Prencipe (2008) examine the capability configurations that are required to develop integrated solutions under different conditions, while Neu and Brown (2005) explore the contingent nature of enabling conditions for the creation of successful B2B services in good-dominant firms.

Nevertheless, the emphasis on case studies and reliance on quadrants 1 (inductive theory building) and 3 (interpretive sensemaking) in Figure 1 makes it difficult for servitization scholars to provide systematic explanations of firm-level outcomes from servitization (Kohtamäki *et al.*, 2019; Zimmer *et al.*, 2020). In order to facilitate theory development and the broader adoption of methods specifically developed to address causality, we next present two relatively underused or emerging methodological approaches in servitization—fsQCA and quantitative experiments. These methods address quadrants 2 (natural experiment) and 4 (contextualized explanation) of the theory development matrix (see Figure 1) proposed by Welch *et al.* (2011).

3. fsQCA and experiments as methods suited for building causal explanations

In this section, we first explain how fsQCA and experiments differ from the qualitative case study approach and then provide a more detailed explanation of how to apply these methods in the servitization domain.

3.1 Comparison of fsQCA and experiments and the case study approach

Table 1 provides a summary of the key features of fsQCA and experiments and highlights the differences from the case study approach. For illustrative purposes, the table presents case studies in the manner in which Eisenhardt (1989, 1991) conceptualizes them.

As evident from Table 1, fsQCA strives for theory development and emphasizes cases as the unit of analysis (Ragin, 2000). fsQCA is specifically suited to building causal explanations through specification of cause–effects relationships that result in equifinal paths to an intended outcome (Fiss, 2011). The method is inductive in the sense that the role of prior theory is not to predict effective configurations but rather to identify possible sets of conditions that are relevant for inclusion in the analytical procedure and to interpret the effective configurations that emerge from the analytical procedure (Ragin, 2000).

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	Case studies	fsQCA	Experiments	
Stage of theory development	Theory building (Exploration)	Theory building (Exploration)	Theory testing	
Types of data	Qualitative data	“Quantified” qualitative and quantitative data	Quantitative data	
Unit of analysis	Cases (usually of firms, but also individuals or organizational units)	Cases (usually of firms, but also individuals or organizational units)	Usually individuals, but also firms or organizational units	
Sample size	Small N (10 or less)	Medium or large N	Depends on the experimental design; minimum of 30 per studied condition	
Mathematical foundation	None	Set relations	Usually frequentist statistics (alternatively Bayesian)	
Analytical logic	Inductive	Inductive	Deductive	
Nature of causality	Observed sequence of phenomena (weak form of causality)	Complex causal patterns (medium form of causality)	Intervention-based causality (strong form of causality)	
Role of theory	Interpretation of empirical findings to support proposition development	Identification of the relevant conditions to be included in the analytical procedure and interpretation of the identified configurations	Hypothesis development	
Intended outcome	Formation of propositions	Specification of cause–effect relationships that result in equifinal paths to an intended outcome	Specification of cause–effect relationships	

Table 1.
Comparison of the key features of case studies, fsQCA and experiments

Experiments are deductive in nature and enable the testing of cause–effect relationships through an intervention-based logic. Thus, experiments provide the most rigorous means of testing theory, but require strongly reduced complexity so that researchers can directly intervene in the suspected cause–effect relationship by systematically changing the cause and measuring the effect under carefully controlled conditions (Field and Hole, 2002; Kirk, 2012). Thus, the manner in which experimental researchers understand and treat causality is very different from the manner in which it is understood in applications of fsQCA: the latter attempts to identify complex configurations of causal patterns that lead to a certain outcome; however, for experimental researchers, the causal explanation lies in the different treatment of at least two subgroups. The more intervening factors the experimenter has under control, the more valid is the causal conclusion. In the next section, we discuss both these methodological approaches in greater detail and provide concrete examples of their application in the servitization domain.

3.2 fsQCA: causal inference by embracing complexity

fsQCA embraces the notion of causal complexity, whereby multiple explanatory factors combine to result in alternative paths to an intended outcome (Meyer et al., 1993; Misangyi et al., 2017; Tsoukas, 2017). As an analytical method, fsQCA builds on the configuration theory with configurations defined “as any multidimensional constellation of conceptually distinct characteristics that commonly occur together” (Meyer et al., 1993, p. 1175). fsQCA bridges semantic and syntactic approaches to explanation building by combining analytical, fine-grained knowledge on how the elements of the configuration interact with holistic,

synthetic knowledge on the orchestrating themes that underlie the identified configurations of conditions (Furnari *et al.*, 2020).

The notion of strategic fit is key in configuration theory whereby different conditions in a particular context are not intrinsically important. What is of importance is how the conditions align (Venkatraman, 1989) to form gestalts or coherent configurations (Ragin, 2000) that lead to a specific outcome of interest. The notion of fit entails several assumptions, such as equifinality, causal asymmetry and a distinction between necessary and sufficient conditions.

Equifinality builds on the idea that multiple configurations of conditions can lead to an outcome of interest (Doty *et al.*, 1993), whereas *causal asymmetry* refers to the notion that the same conditions can lead to different outcomes, depending on how such conditions are arranged (Ordanini *et al.*, 2014). Moreover, configurational theory distinguishes between *necessary and sufficient conditions*. Necessary conditions must always be present for an outcome to occur, whereas sufficient conditions may be present and, if so, help bring about the outcome.

Cases are the primary sources of knowledge, with focus placed on systematically analyzing how cases cluster into configurations of conditions that explain an outcome of interest (Furnari *et al.*, 2020). The configurational understanding of cases as “complex wholes” is made possible through use of the set-theoretic approach and Boolean algebra (Ragin, 1987), the application of which allows distinguishing QCA from conventional correlational methods and enables researchers to effectively conceptualize and analyze causal complexity (Misangyi *et al.*, 2017).

Through the application of the set-theoretic logic to the analysis of individual observations or cases, this analytical approach conceptualizes cases as configurations of theoretical attributes (Ragin, 1987, 2000). The study of these individual observations or cases helps to understand how the combinations of conditions in effective configurations interact and whether certain single conditions or a set of conditions are necessary or sufficient for an outcome to occur (Fiss, 2011; Kraus *et al.*, 2018). Several equivalent, occasionally even contradictory, paths can lead to the desired solution.

3.2.1 Application of fsQCA to servitization research. fsQCA originates from political science and sociology literature, with relatively few application examples found from the servitization stream of research (see Table 2). Ordanini *et al.* (2014) were the first to utilize fsQCA in servitization to understand which new service attributes and coproduction requirements lead to new service adoption. Since then, servitization scholars have applied fsQCA to understand the complex interplay of drivers of conditions that explain financial and operational-level outcomes from servitization. The analyzed outcomes include enhanced firm profitability (e.g. Ambroise *et al.*, 2018; Lexutt, 2020), successful service infusion (e.g. Böhm *et al.*, 2017; Forkman *et al.*, 2017) and salesperson engagement in solution selling (Salonen *et al.*, 2021).

The explanatory conditions included in the analyses range from the required resources and capabilities (Sjödén *et al.*, 2016); type of service offering (Forkman *et al.*, 2017; Bustinza *et al.*, 2019; Lexutt, 2020); service infusion process (Forman *et al.*, 2017); firm size (Böhm *et al.*, 2017); governance strategies (Sjödén *et al.*, 2019); service pricing (Forkman *et al.*, 2017); and structure, leadership and service culture (Lexutt, 2020). The number of cases analyzed ranges from 50 (Sjödén *et al.*, 2019) to 370 (Bustinza *et al.*, 2019). Forkman *et al.* (2017) include a dyadic dataset with studied conditions that involve both suppliers and customers.

Explanatory conditions included in the analytical procedure can also operate at multiple levels of the studied organization. For example, Salonen *et al.* (2021) address the managerial challenge of how manufacturers can transform a product-focused sales force to undertake solution selling. This transformation results from an intricate interplay of individual salesperson and organizational-level drivers, with the latter incorporating actions by sales management and subtler forms of social influence by peers.

Study	Research question/purpose	Key analyzed conditions	Literature base and data	Key findings
Ordanini <i>et al.</i> (2014)	Which new service attributes and coproduction requirements lead to new service adoption?	New service attributes (relative advantage, complexity, meaningfulness, and novelty); co-production requirements (high, moderate, low)	Service design, customer participation Luxury hotel context, 300 participants, survey/ interviews	Three distinct configurations can stimulate service adoption, with relative advantage being a necessary condition. In addition, new service adoption can be induced when a new service is perceived as (1) non-complex and involving a high degree of coproduction; (2) novel but requiring low coproduction effort; or (3) both novel and meaningful, irrespective of the amount of coproduction required
Sjödin <i>et al.</i> (2016)	To identify and explain capability configurations for advanced services offerings in manufacturing firms	Service development, mass service customization, network management and digitalization capabilities (high/ low)	Resources and capabilities Survey of 131 manufacturing firms	Identifies four capability configurations that enable advanced service offerings in manufacturing companies, including (1) high mass service customization, digitalization, and network capabilities; (2) high digitalization and service development, but low network management capabilities; (3) high mass service customization and low network management and digitalization capabilities; and (4) high service development and network management, but low mass service customization and digitalization capabilities
Böhm <i>et al.</i> (2017)	Whether a healthy financial situation is a necessary requirement for a successful service transition	Strategy (service emphasis), resources (financial situation; firm size) and knowledge sources (customer links; supplier links)	Strategic change Survey of 294 firms in the mechanical engineering industry	Identifies three configurations for successful service transitions with large firm size identified as a necessary condition. In addition (1) a healthy financial situation and strong customer links, (2) healthy financial situation; strong customer links; strong supplier links or (3) deteriorating financial situation; weak customer links; strong supplier links induce healthy financial outcomes from servitization
Forkman <i>et al.</i> (2017)	To understand driver configurations for successful service infusion	Service offering (SSP/ SSC), service infusion process (radical/ incremental), service pricing (price de-bundling), supplier service capabilities (internal/external)	Service infusion, business model theory Interviews with 94 suppliers and 43 customers across 25 business relationships	Identifies three different configurations for supplier, four different configurations for customer, and five different configurations for dyadic service infusion value
Ambroise <i>et al.</i> (2018)	Which combinations of servitization strategies and customer-oriented organizational designs improve the manufacturer's profitability	Servitization strategy (added services, activities/ business model reconfiguration) customer-oriented organizational design (service culture, customer interface and service delivery system)	Organizational design Survey of 184 SMEs in a manufacturing industry	Added service strategy does not need complex customer-oriented organizational design, activity reconfiguration strategy needs a strong service delivery system and business model reconfiguration strategy needs a robust service culture

(continued)

Table 2.
Existing fsQCA
studies in servitization
literature

Study	Research question/purpose	Key analyzed conditions	Literature base and data	Key findings
Bustinza <i>et al.</i> (2019)	Make-or-buy configurational approaches in product-service ecosystems and performance	Base services (service parts, warranty contracts), intermediate services (cost-plus service contracts, maintenance contracts), advanced services (value-added services)	Survey of 370 manufacturing firms in seven industries	Identifies industry-specific configurations for optimal boundary conditions. Only the configuration where base and intermediate services are outsourced and advanced services developed in-house maximizes business and organizational performance in all sectors
Sjödín <i>et al.</i> (2019)	How providers govern customer relationships to realize profits through servitization	Service innovation, perceived switching costs, attractiveness of alternatives and explicit contracts	Governance strategies Survey of 50 advanced service providers	Identifies three configurations of relational governance strategies that lead to superior financial performance by advanced service providers. High service innovation is a necessary condition present across all effective configurations. In addition, (1) low attractiveness of alternatives and low use of explicit contracts; (2) high perceived switching costs and low use of explicit contracts; or (3) low perceived switching costs, high attractiveness of alternatives and high use of explicit contracts drive financial performance in servitization
Lexutt (2020)	What are potential different roads to servitization success (both financial and nonfinancial)?	Strategy (SSP or SSC offering), structure (decentralization or centralization), leadership (management commitment to service business), culture (service orientation)	Servitization success Survey of 143 firms in the manufacturing sector	Across the effective configurations, the three necessary conditions are decentralization, management commitment and service orientation of corporate culture. In addition (1) a limited offering of SSC, regardless of structure or the offering of SSP; or (2) a product-oriented service offering, regardless of structure or the offering of SSC or (3) a separate service organization, regardless of the offering of SSP or SSC drive servitization success
Salonen <i>et al.</i> (2021)	How a product-focused salesforce can be engaged in solution selling	Salesperson-level conditions (solution experience, value-based selling, solution risk perception); organizational-level conditions (management's communication of role expectations and training; solution champions' market-shaping behavior)	Salesforce transformation Multilevel survey with a single supplier, including 184 salespeople, 23 solution champions and 26 sales managers	Identifies five different configurations that result in solution-selling engagement; value-based selling is the only necessary condition in all configurations, while other conditions can be present or absent depending on situational fit

Table 2.

Thus, the resulting configurations of individual salesperson and organizational-level conditions represent alternative pathways to engaging a heterogeneous sales-force in solution selling.

3.2.2 *The main steps in the application of fsQCA.* In applying fsQCA, researchers must pay attention to case selection, the choice of explanatory factors and their operationalization,

calibration, presentation of the analytical steps and the thresholds for consistency and coverage values (Wagemann *et al.*, 2016, p. 2016). The fsQCA analytical procedure can be conducted with the aid of the fs/QCA 3.0 software package (Ragin and Davey, 2016).

3.2.2.1 Calibration and transformation of conditions. fsQCA is based on a study of causal conditions that interact to effect an outcome of interest. The number of explanatory conditions incorporated into a single study typically ranges between four and eight (Wagemann *et al.*, 2016). It is possible to calibrate datasets from a wide range of data sources, both qualitative and quantitative. Prior application examples by servitization scholars show preference for utilizing quantitative data, with surveys being the typical method of data collection (see Table 2). Data analysis begins with calibrating the measures for the studied conditions into fuzzy set scores that range from zero to one. Determination of the degree of membership in a studied condition requires setting of thresholds for non-membership, full membership and indifference for each studied condition.

3.2.2.2 Identification of necessary conditions. fsQCA seeks to identify commonalities across cases that form consistent subset relations between theoretically relevant conditions and outcomes of interest (Ragin, 2000). This requires establishing the *necessity* of a condition(s) in observing an outcome. A necessary condition is such where all cases experiencing the desired outcome also display the condition in question. However, not all the cases displaying the necessary condition(s) must exhibit the outcome (causal asymmetry). The necessary conditions identified in prior servitization research that result in desired outcomes include relative advantage (Ordanini *et al.*, 2014); large firm-size (Böhm *et al.*, 2017); high service innovation (Sjödin *et al.*, 2019); and decentralization, management commitment and service orientation of corporate culture (Lexutt, 2020).

3.2.2.3 Construction of a truth table. fsQCA's set-theoretic approach enables researchers to also consider configurations that do not exist in the data through "counterfactual analysis." This refers to researchers' evaluation of the outcome that an unobserved configuration would generate were it present in the data set (Soda and Furnari, 2012). To aid in this process, fsQCA uses a Boolean chart—referred to as a "truth table"—to capture and examine all logically possible combination of attributes.

3.2.2.4 Identification of sufficient conditions. The analytical procedure continues with the identification of sufficient conditions or combinations of them. This implies that the condition is a subset of the specific outcome, which would provide evidence for the *sufficiency* of the condition for the outcome. Here, while sufficiency implies that all cases possessing the conditions(s) must experience the outcome, there will likely be other cases that experience the outcome that do not possess the same conditions(s).

Some prior servitization studies have identified only configurations of sufficient conditions. For example, Sjödin *et al.* (2016) identify four capability configurations that consist of various combinations of service development, mass service customization, network management and digitalization capabilities. None of these conditions is necessary, but in different combinations, these conditions are sufficient to enable advanced service offerings in manufacturing companies. Others explain how necessary conditions, like salesperson value-based selling capability, combine with sufficient conditions related to the communication from sales management of role expectations and training as well as the market-shaping behavior of solution champions to engage product-oriented salespeople in solution selling (Salonen *et al.*, 2021).

3.2.2.5 Interpretation of results. The analytical procedure described above enables the identification of effective configurations of conditions that interact to produce the outcome of interest. Interpretation of the effective configurations is guided by theory and understanding of the context surrounding the cases under study. As an example, Salonen *et al.* (2021) draw upon long-term research collaboration with a European manufacturer spanning over 10 years to facilitate access to the relevant cases (i.e. individual salespersons nested in sales

organizations undergoing a solution transformation) and to interpret the resulting effective configurations.

3.2.2.6 Coverage and consistency. In fsQCA, coverage and consistency scores are used to evaluate the strength of the empirical support on which theoretical arguments are based. Coverage captures the empirical relevance of an identified configuration, whereas consistency assesses how an identified configuration consistently explains the outcome of interest in the analyzed data set (Ragin, 2006). Consistency scores must be as close to 1.0 as possible and must not fall below 0.75 (Ragin, 2006; Wagemann *et al.*, 2016). Unlike with consistency, a low coverage score for an individual configuration does not automatically imply that the configuration in question is theoretically irrelevant. However, if all the identified configurations capture a relatively low proportion of the outcome, it may be that the researcher has not included the right set of causal conditions into the analysis (Ragin, 2006).

3.3 Experiments: causal inference through reducing complexity

Experiments are considered as the most rigorous approach to building causal explanations, as it is the only method that enables the drawing of direct causal conclusions through reliance on an interventionist logic (Pearl, 2009). In experiments, researchers directly intervene in the suspected cause–effect relationship by systematically changing the cause and measuring the effect. Thus, unlike fsQCA, experiments assume *causal linearity* for which the following three criteria must be met (Shadish *et al.*, 2002): (1) presumed cause and presumed effect occur together and vary together, (2) the presumed cause precedes the presumed effect and (3) alternative explanations for the effect can be precluded.

3.3.1 *Application of experiments to servitization research.* Disciplines in business research that have their roots in applied psychology or sociology, such as consumer and organizational behavior or leadership research, show an affinity for experimental research methods. However, servitization has no established link with these empirical social sciences, which is a partial explanation for the rarity of experiments in servitization.

Secondly, the implicit focus of much of servitization research is on the business-to-business (B2B) context, where the necessary sample sizes are more difficult to achieve as compared to in business-to-consumer (B2C) research. Further, B2B requires a higher commitment of the industrial research partner, whereas in B2C, scientists have the option to use consumer panels (or with restrictions, even student samples) without any industrial involvement. Thus, B2B researchers rarely utilize experimental methods (for exceptions, see, for example, Anderson and Wynstra, 2010; Geiger *et al.*, 2015; Upreti *et al.*, 2021).

In a similar manner, with a few rare exceptions (see next section for exemplary studies), experimental research has been neglected by servitization scholars. To encourage greater application of this method, we provide a summary of key design choices that researchers need to make in the context of experiments and explain how the few prior examples that can be found in the servitization domain have applied this method.

3.3.2 *Main steps in applying an experimental research strategy.* In planning an experimental research strategy, the researcher needs to select an appropriate experimental design that builds on a solid theoretical foundation, while paying attention to internal and external validity.

3.3.2.1 *Choice of theoretical foundation.* To apply experiments, servitization scholars need to specify very narrowly focused research questions that aim to test hypothesized relationships among key variables of interest (Shadish *et al.*, 2002). Given the theoretical nascence of the servitization domain, experimental research will likely require the adoption of well-established theories from adjacent and more mature fields of study to formulate the hypotheses to be tested (Baines *et al.*, 2017; Li *et al.*, 2020).

As an example, Zimmer *et al.* (2020) rely on two scenario-based online experiments to demonstrate that positioning oneself in the market as a B2B solution-seller has a highly significant and positive effect on the customer's purchase intention in cases where the customer is only considering the purchase of a single, product-based component. The authors build on the signaling theory (Spence, 1973, 2002) to build the main effect hypothesis and on existing solution business research to expand the model to include mediating and moderating variables. More specifically, beyond demonstrating that the signaling effect of solution business exists (i.e. customers prefer to buy products from solution providers over non-solution providers), the authors are able to explain how this signal functions (through a risk reduction mechanism and in the presence of signal credibility in the form of prior reference projects).

In another example, Becker *et al.* (2020) investigate how to increase the effectiveness of proactive post-sales services (PPS) (cf. Challagalla *et al.*, 2009). The authors derive their hypotheses from literature on motivation ambiguity, ambidexterity (service employees in a role conflict between serving and selling) and privacy concerns. In a field experiment in the telecommunication industry and in a controlled laboratory experiment, the authors find that PPS are generally effective, but companies must refrain from cross-selling activities during PPS if customers question the motives of these companies. The effectiveness of PPS is also influenced by the intrusiveness of the contact medium; the more customers perceive the communication as intrusive, the higher the churn rate.

Kuijken *et al.* (2017) build on several theories of customer perceived value and postulate that products and service elements of a PSS must possess both autonomous and synergetic values. They test their framework on the supplier side by conducting a descriptive study among service development professionals and, on the demand side, by running a scenario experiment among end customers.

In the B2C realm, Jörling *et al.* (2019) built their experimental study on perceived responsibility of service robots for service outcomes on several theories from a wide range of research fields, including the attribution theory, technology acceptance and psychological ownership. Further, Viglia *et al.* (2019) utilize the uncertainty theory for their series of experiments on the timing of pay-what-you-want pricing for services. Blut *et al.* (2020) investigate the dark side of customer co-development of services. They derive their hypotheses from the theory of role stress.

3.3.2.2 Development of the experimental design. Experimental research requires upfront development of a research model that specifies the hypotheses to be tested in an experimental setting (Field and Hole, 2002). A single study usually includes several rounds of experiments, where during the first round, the researcher establishes the main effect and then subsequently expands the model to include mediating and moderating variables. An essential element of experimental research is the strict random assignment of participants to experimental conditions (Kirk, 2012). If this is not possible—for example, because customers have pre-selected themselves by purchasing certain products or the allocation to the experimental groups is based on existing segmentations—internal validity is strongly limited (Ibid). Research strategies that are restricted in this manner are called *quasi-experiments* or *natural experiments* (Shadish *et al.*, 2002).

The classical experiment is based on the *between-groups design*, where one group receives the experimental treatment (experimental group) and the other does not (control group). The test effect results from statistically significant differences in mean values for continuous dependent variables or significant differences in frequency for categorical variables. While in traditional experiments each participant receives only one treatment, depending on which experimental group he or she is in, in *within-subject designs* each participant receives all treatments sequentially. The presentation of several stimuli is more similar to an actual decision situation, which increases the external validity of the experiment (Charness *et al.*, 2012).

Scenario experiments are a variant of laboratory experiments. Here, hypothetical situations are presented to the test persons in short texts (“vignettes”) (Alexander and Becker, 1978). Scenario-based experiments can be challenged for lack of external validity. This is because typical dependent variables in such experiments are based on attitudes or intentions. Thus, the crucial step to actual behavior is missing (intention-behavior-gap). Nevertheless, due to their higher internal validity, scenario experiments are an interesting alternative for servitization scholars for theory testing purposes (Aguinis and Bradley, 2014).

Field experiments take place in the actual environment of the participants (Gneezy, 2017). In most cases, they require cooperation with an industry partner. The experimental treatment aims at actual changes in behavior (e.g. different buying behavior due to varying price levels). Field experiments are rather easy to implement if the interaction with the customer takes place via digital channels and instruments (Nelson *et al.*, 2020). The necessary *ceteris paribus* condition is much easier to realize in an exclusively digital environment—for example, by systematic manipulation of single keywords in e-mail messages, while the remainder of the message and all other factors remain unchanged.

Often several different types of experiments are conducted in experimental studies to compensate for the advantages and disadvantages of each type. For example, Becker *et al.* (2020) combine field and lab experiments to strengthen internal and external validity. In their study on selection criteria for B2B services, Wuyts *et al.* (2009) combine a between-groups experiment and a conjoint experiment, which better reflects trade-off decisions, for example, for price. Zimmer *et al.* (2020) combine between-groups and within-subject experiments to better reflect real-life decisions.

Complexity in experiments is reflected by the number of independent variables (usually called “factors” in experiments) and the number of factor levels. Several factor levels help to better reflect the variability in reality (e.g. different price levels or types of services), while several factors enable the testing of interaction effects and, thus, conditional statements. Appropriate software (e.g. G*Power) must be used to estimate the required sample size.

3.3.2.3 Internal and external validity. The concept of validity is of central importance in experiments. Internal validity refers to the extent to which a causal conclusion can be drawn (Kirk, 2012). It is high if changes in the dependent variable are only caused by the experimental treatment and external influences can be excluded or controlled. External validity refers to the transferability of the results from the experimental setting to the real world. It is usually inversely linked to internal validity. External validity is usually lower for laboratory experiments (Lynch, 1999) because the artificial environment does not adequately reflect the actual decision-making situation (e.g. in the case of complex purchase decisions for industrial services).

4. Future research agenda: opportunities for the application of fsQCA and experiments in servitization

In the preceding section, we have discussed fsQCA and experiments as approaches that are well-suited to developing causal explanations and argue that their more wide-spread adoption would respond to recent calls that urge for greater methodological diversity in servitization (Kowalkowski *et al.*, 2017; Rabetino *et al.*, 2018; Li *et al.*, 2020; Rabetino *et al.*, this issue). In this section, we consider specific application areas for these methods in the servitization domain.

4.1 Application of fsQCA in the servitization domain

As noted by Kohtamäki *et al.* (2019), contingencies clearly play a role in servitization. This implies that various configurations of necessary and sufficient conditions combine to form

successful configurations that explain an outcome of interest in the studied contexts. Given the complexity of the servitization phenomenon, the ability of fsQCA to distinguish among those conditions that are necessary and those that are sufficient is a particular strength. It enables a better understanding of what managers must “get right” to effect an outcome, while simultaneously accounting for situational contingencies.

In prior servitization research (see [Table 2](#)), fsQCA has mostly been adopted by researchers who work with quantitative data sets. It appears that quantitatively oriented servitization scholars have become aware of the advantages posed by fsQCA compared to, for example, regression-based methods. If one accepts the notion of complex causation, it becomes evident that differential and occasionally counterintuitive effects of the same driver are masked in analyses that rely on net effects thinking characteristic of regression-based approaches ([Kohtamäki et al., 2019](#)). This is because regression analyses identify “the one and only model” that best represents the empirical data ([Schneider and Eggert, 2014](#), p. 314). Thus, regression analyses are most appropriate when the aim of researchers is to test how much a particular variable influences the outcome. In principle, interaction effects also enable the representation of complex relationships in regression-based research. However, interactions with orders higher than two are usually difficult to interpret. Consequently, an understanding of the complex causal paths requires configurational thinking and applications of fsQCA. For future direction, we would encourage wider uptake of fsQCA by scholars utilizing qualitative data sets in instances where the research objective is to develop a contextualized explanation of the studied phenomenon (see [Figure 1](#)).

Further, in future applications of fsQCA—whether one is building on quantitative or qualitative data sources—we also encourage more research that incorporates multiple levels of analyses into the development of causally complex explanations. As noted by [Calabrese et al. \(2019\)](#), servitization can be identified and measured at the firm level; the level of individual employees, which serve as the micro-foundation for servitization; and at the product level. Further, often, actions by actors in the broader ecosystem—such as customers and suppliers—are critical to ensure desired outcomes from servitization. Thus, it is likely that conditions operating on multiple levels combine to form successful configurations that explain an outcome of interest in servitization (see [Salonen et al., 2021](#)).

4.2 Application of experiments in the servitization domain

Unlike in applications of fsQCA, experiments build on the assumption that there is only one causal path to an intended outcome. Experiments are arguably most suited to situations when researchers target narrowly defined research questions and the outcome variable relates to customer behaviors or perceptions. For example, what drives the customers’ willingness to accept value-based pricing and gain-sharing contracts for servitized offerings ([Töytäri et al., 2017](#); [Keränen et al., 2020](#))? Since internal validity is important in experiments with a focus on theory testing, we recommend conducting lab experiments, if appropriate, in combination with scenario techniques.

Despite the potential application challenges associated with experiments when studying a complex real-life managerial phenomenon like servitization with weak theoretical underpinnings, we encourage more uptake of this method. Experiments represent the strongest form of causal explanation ([Field and Hole, 2002](#), p. 10) and can offer useful platforms of engagement with industry, as the reductionist, complexity-reducing nature of experimentation is intuitively appealing to managers.

In fact, a hype has grown around “smart business experiments”—a term that has been developed by business practitioners ([Gandhi and Johnson, 2019](#); [Thomke, 2020a](#)).

Smart business experiments aim at rapid testing of product and service innovations or improvements, pricing or CRM measures (customer communication, vouchers, etc.). For example, HP experimented with different enrollment offers for their “Instant Ink” subscription service and was able to increase the enrollment rate by 37% (Optimizely, 2021).

Rapid field experiments provide managers clear answers to narrowly defined questions, which can usefully guide managerial decision-making. However, managers seldom consult scientific theories and instead base experimental designs on implicit causal beliefs formulated through practice. This presents an opportunity for servitization scholars to elicit the theoretical underpinnings of the implicit assumptions of managers. Simultaneously, servitization scholars would benefit from the “culture of experimentation” (Thomke, 2020b) that is currently growing in numerous companies. If utilized correctly, experiments can result in explanations of key phenomena of interest to servitization scholars that have both high practical and scientific value.

If practitioners fear that inferior experimental conditions (e.g. ineffective e-mail communication or suboptimal pricing, cf. Feit and Berman, 2019) will have a negative impact on the company’s profitability during the test period, so-called *adaptive testing* is recommended (cf. Misra et al., 2019). This will continuously optimize the allocation of test subjects to the test conditions in terms of effectiveness—for example, maximizing the profit or the number of conversions. In the following section, we highlight more specific research areas that could offer particularly fruitful opportunities for the application of fsQCA and/or experimental research designs in the servitization domain.

4.3 Overview of thematic areas for future research

Given that the contemporary servitization literature is broad and thematically diverse, we use the classification of five central themes given by Raddats et al. (2019) as a means to structure exemplary research questions that could be addressed through the application of fsQCA and/or experimental research designs. These themes include service offerings; strategy and structure; performance; resource and capabilities; and service development, sales and delivery.

In terms of service offerings, extant servitization research has provided multiple and often overlapping taxonomies and categorizations to classify different types of service offerings. These usually range from differentiating services based on whether they are considered as complements or substitutes (Cusumano et al., 2015), basic or advanced (Baines and Lightfoot, 2013) or whether they support the supplier’s product or the customers’ process (Mathieu, 2001) and provide input- or output-related customer outcomes (Tukker, 2004; Ulaga and Reinartz, 2011). However, an understanding is missing of the relative importance of these different types of service offerings for the manufacturer’s servitization success or of the risks that relate to providing such services (Raddats et al., 2019).

With regard to strategy and structure, while extant servitization research has identified and described multiple different strategic options and organizational structures that support the transition toward services, “literature is far from conclusive about which manufacturer service strategy is most applicable” under different conditions (Raddats et al., 2019, p. 8). Further, most of this research is focused on internal, organic and unidirectional service growth strategies, but lacks substantiated insights on external, network-based and multi-directional trajectories (Kowalkowski et al., 2017; Luoto et al., 2017). While the choice of suitable organizational structure for servitization is usually closely linked to a selected strategy, extant research provides mixed findings in terms of whether and when integrating or separating services is a superior organizational configuration (Raddats and Burton, 2011).

Also, a key theme in extant servitization research has been the resources and capabilities that manufacturers require in order to transition successfully into services (Paiola *et al.*, 2013; Eloranta and Turunen, 2015). While previous research has identified and described an extensive list of resource-capability combinations that are related to different servitization strategies (e.g. Storbacka, 2011; Ulaga and Reinartz, 2011; Kindström *et al.*, 2013), most of it is explorative and descriptive in nature and lacks empirical insights on the differential impacts of specific resources and capabilities under different conditions (Sjödin *et al.*, 2016). Further, most of the current literature is focused on the resources and capabilities required by focal suppliers, while more research is required to understand the impacts of resources and capabilities needed by customers and other network partners in different servitization contexts and situations (Forkman *et al.*, 2017; Raddats *et al.*, 2019).

Extant servitization literature on service development, sales and delivery has focused on exploring how to generate new or added value through service-related processes and capabilities (Raddats *et al.*, 2019). However, while most of this research has highlighted the key differences between service and product-related processes and/or challenges in the transition from products to services (Storey *et al.*, 2016; Kowalkowski and Ulaga, 2017), the specific conditions under which service-centered processes become superior remain unclear. In addition, while service sales and delivery processes have been studied at the salesforce level (Ulaga and Loveland, 2014; Panagopoulos *et al.*, 2017), research on the management and organization of the sales function and the service delivery processes at the organizational level remain scarce (Raddats *et al.*, 2019).

Table 3 provides a summary of example research questions for the application of fsQCA and experiments that future servitization research could address within these thematic areas. In the column that summarizes potential opportunities for experimental research, a suggestion is made regarding what typology of experiments (FER = field experiment with true randomization, NFE = natural (quasi-) field experiment without randomization, SER = scenario-based laboratory/online experiment with true randomization) is likely to be the most applicable design choice. An assessment of the appropriate design choice depends, among other things, on the possibility to manipulate independent variables in an experimental setting and to randomly assign participants into test groups. In experimental research that takes place outside of laboratory settings (as is likely to be the case with a real-life managerial phenomenon like servitization), researchers will need to find a suitable compromise that sufficiently addresses internal and external validity-related concerns. For example, if the experiment requires collaboration with an industry partner, this will place constraints on the extent to which variables can be controlled and manipulated.

Table 3 should be interpreted as illustrative, since in numerous cases, interesting research questions will cut across these thematic areas. For example, a long-debated issue in servitization has been whether engagement in advanced services like customer solutions leads to enhanced performance for the focal firm (Worm *et al.*, 2017). It appears that compared with other service offerings, solutions are in fact associated with an increased return on sales (Worm *et al.*, 2017). In realizing this effect, the activities of the salesforce are critical (Worm *et al.*, 2017; Panagopoulos *et al.*, 2017), as are conditions related to the firm's product portfolio scope, sales unit cross-functional cooperation, and customer-supplier relationship tie strength (Panagopoulos *et al.*, 2017). An fsQCA analysis would reveal how combinatory effects of such conditions (and perhaps others) facilitate the ability of the focal firm to derive increased return on sales from solutions and whether some conditions emerge as more critical than others. However, if the suspected cause can be reduced to one or a few factors, then experiments are a much rigorous form of providing explanations due to the interventionist logic employed in this method.

	fsQCA	Experiments (FER = field experiment with true randomization, NFE = natural (quasi-) field experiment without randomization SER = scenario-based laboratory/online experiment with true randomization)
Service offerings	<ol style="list-style-type: none"> (1) Are there specific organizational, relationship, network or industry conditions that make the adoption or delivery of specific service offering types more effective? (2) Are there specific internal or external conditions under which different service offering types become more challenging, risky or unprofitable to develop or deliver? 	<ol style="list-style-type: none"> (1) Does the range or diversity of service offerings have differential performance, cost, and/or risk implications, or does a focus on one specific service offering type improve efficiency, profitability and reputation (NFE)? (2) Are there differences between customer perceptions of customized versus modular service offerings or internally vs externally integrated service offerings (FER, SER)?
Strategy and structure	<ol style="list-style-type: none"> (1) What are the conditions that make internal or external servitization strategies superior, and do similar conditions hold true in developed and developing countries or in mature and emerging industries? (2) What are the key internal and external conditions that favor different organizational structures for servitization? 	<ol style="list-style-type: none"> (1) Does the adoption of incremental vs radical or internal versus external service growth strategies elicit different customer risk perceptions (NFE)? (2) Does integrating vs separating service and product units influence customer perceptions in terms of reputation, credibility, or trust or does the use of service specialists versus generalists improve customer satisfaction or other customer outcomes (NFE, SER)?
Motivations and performance	<ol style="list-style-type: none"> (1) Under what conditions is service bundling or de-bundling a superior pricing strategy? (2) Which individual and organizational conditions are necessary to facilitate the profitability and customer acceptance of new service pricing? 	<ol style="list-style-type: none"> (1) Does customer willingness-to-pay or price fairness perceptions differ between different service offerings or pricing models and, if so, what are the key drivers and potential thresholds for different pricing levels (FER, SER)? (2) How do specific service pricing communication or framing strategies influence customer acceptance and/or fairness perceptions of different service offerings (FER, SE)?
Resources and capabilities	<ol style="list-style-type: none"> (1) What are the different supplier, customer, and network resource and capability configurations that drive successful servitization efforts in different situations? (2) Are there specific conditions that drive the choice of "make or buy" decisions for different resources and capabilities at different firm boundaries? 	<ol style="list-style-type: none"> (1) Does the internal development or external acquisition of specific resources or capabilities improve servitization outcomes and, if so, are there differences between various service offering types (NFE)? (2) Do specific customer or network resources and capabilities facilitate or hinder servitization and, if so, are they dependent on a specific customer resource integration style, effort or network position (NFE)?

Table 3. Summary of the potential research questions for the application of fsQCA and experiments in future servitization research

(continued)

	fsQCA	Experiments (FER = field experiment with true randomization, NFE = natural (quasi-) field experiment without randomization SER = scenario-based laboratory/online experiment with true randomization)
Service development, sales, and delivery	<ol style="list-style-type: none"> (1) Under what conditions do service-centered innovation, sales and delivery processes lead to superior outcomes? (2) Which internal and external conditions make vendor and customer organizations more (or less) receptive to value-based service selling approaches? (3) Which supplier, customer, or network conditions influence the success of service delivery and deployment over products? 	<ol style="list-style-type: none"> (1) Do product and service customers react differently to specific types of sales arguments and/or do specific sales arguments resonate differently to customer decision-makers in different functional roles or departments (FER, SER)? (2) Do specific service delivery styles improve customer satisfaction, perceived value, and/or contract renewal (FER, SER)? (3) Does the automation or digitalization of service delivery improve operational and relational outcomes equally well, or are there potential tradeoffs (FER, SER)?

Table 3.

5. Conclusions

5.1 Theoretical and methodological implications

Despite being considered an established field of study in terms of research output, servitization suffers from persistent theoretical nascence and an over-emphasis on descriptive and explorative case studies (Kowalkowski *et al.*, 2017). This state of affairs has led to numerous recent calls for greater methodological diversity (Kowalkowski *et al.*, 2017; Rabetino *et al.*, 2018; Li *et al.*, 2020; Rabetino *et al.*, this issue). In response to this call, the purpose of this study has been to explain how the application of fsQCA and experiments can advance theory development in servitization through the generation of better causal explanations.

Against this background, this study makes three key contributions. First, we explain why theory development in servitization requires adoption of methods that allow development of causal explanations of firm-level outcomes from servitization (Welch *et al.*, 2011). Second, we explain how fsQCA and experiments provide complementary ways of developing and testing theory when the research objective is to understand the causal pathways that lead to observed outcomes. More specifically, as an exploratory approach that builds on the study of cases, fsQCA enables researchers to uncover “different recipes for success” through a configurational logic (Forkmann *et al.*, 2017). On the other hand, experiments build on the assumption that there is only one causal path to an intended outcome and this path is uncovered through an interventionist logic. While fsQCA is an emerging methodology in servitization research, experiments remain virtually unused.

Third, this study develops a research agenda for the application of fsQCA and experiments in the servitization domain. Specifically, we highlight relevant research areas in servitization that provide opportunities for the application of fsQCA and experiments and suggest exemplary research questions that could be addressed. This provides concrete guidance and research directions for servitization scholars who wish to apply these methods to develop causal explanations of firm-level outcomes from servitization (Kohtamäki *et al.*, 2019; Zimmer *et al.*, 2020). If implemented with sufficient rigor, fsQCA and experiments have

the potential not only to advance theory development in servitization but also to improve the credibility of the field. This is because younger disciplines typically require the adoption of methods from established disciplines to gain legitimacy (Rabetino *et al.*, 2018).

Taken together, the contributions from this study aim to advance theory development in servitization by encouraging and guiding scholars to adopt more diverse research methods. Of course, an argument could be made that servitization scholars have not applied the prevalent method of qualitative case studies for the purposes of causal explanation, whereby the issue is not the method but rather how the method is applied. However, given the close interdependence between theorizing and methods used to develop theory (Sørensen *et al.*, 2007), we believe that greater methodological plurality is instrumental in helping to advance theory development in servitization through the generation of better causal explanations.

5.2 Managerial implications

For managers and practitioners, this study highlights two specific methods that can be used to identify and understand the causal pathways that lead to managerially relevant outcomes in servitization. Specifically, applications of fsQCA help managers to identify the range of available “recipes for success” in given contexts and to prioritize critical success factors without which an intended outcome is impossible to achieve. For example, a value-based selling capability is a necessary condition to engage product-oriented sales people in solution selling, while other conditions—such as solution experience or provided training—are merely sufficient conditions (Salonen *et al.*, 2021).

On the other hand, experiments support managerial decision-making by providing definitive yes/no types of answers to key managerial questions. In particular, the so-called *smart business experiments* provide simple and swift transformation of an idea into an experiment to promptly arrive at results that are suitable for managerial action (Davenport, 2009; Anderson and Simester, 2011; Gandhi and Johnson, 2019; Thomke, 2020a). While smart business experiments may lack some of the necessary methodological rigor, the ease and speed of their applicability offers incentives for practitioners to conduct or cooperate with scholars in joint field experiments that address business-critical problems.

5.3 Limitations and future research avenues

This study has a few limitations that also could provide potential avenues for future research. First, we considered only the suitability and application of fsQCA and experiments to servitization in the provision of causal explanations. Future studies could expand our insights by considering other approaches that are suited for explaining causality, like modeling. Conceptual mathematical modeling provides profound insights into theoretical cause-and-effect relationships (e.g. Agrawal and Bellos, 2017); structural equation modeling is a powerful tool to test the causal plausibility of correlative relationships (e.g. Sousa and da Silveira, 2017). Finally, statistical modeling is particularly useful in studying the financial performance implications of servitization (e.g. Fang *et al.*, 2008; also see Wang *et al.*, 2018). Moreover, as the phenomenon of servitization matures, the availability of time-series data increases, which provides insights into time-contingent causal relationships.

Second, while we focused on the potential applicability of fsQCA and experiments, future research could—once a critical mass of studies using these methods have been accumulated—delve deeper into the actual research practice and compare how these methods have been applied in the field. This would help to shed light on the “common,” “best” and “innovative” practices in published fsQCA and/or experimental studies (c.f. Piekkari *et al.*, 2010) and analyze their suitability and prevalence in the servitization domain.

Finally, artificial intelligence is rapidly gaining traction as an emerging field of research, and numerous machine-learning algorithms are based on reinforcement learning, which can

be understood as a form of continuous experimentation. For example, areas such as automation (e.g. for sales force), autonomous systems (e.g. service robots) and service development (e.g. every service feature and every customer touchpoint is a result of an experiment for Netflix) provide novel and managerially relevant research questions and contexts for servitization scholars.

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